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THE SO-CALLED BISMUTH BREATH.

By William Reisert, Ph.G.

Abstract from an Inaugural Essay.

Bismuth oxynitrate, when taken into the human system, often imparts to the breath a very perceptible, and disagreeable garlic-like odor, which is very annoying, not only to the person who has taken the salt, but particularly disagreeable to the persons with whom they may come in contact. This odor has been attributed by writers to be caused by impurities in the bismuth salt, such as arsenic and tellurium, and some have asserted that the chemically pure bismuth salt itself produces the odor. The subjoined experiments will add to the already known facts concerning the cause of the production of this odor, namely, the ingestion of tellurium, which element occurs as an impurity in many samples of bismuth oxynitrate.

Chemically pure sesquioxide of bismuth was prepared by dissolving the commercial oxynitrate in chemically pure nitric acid, and precipitating with an excess of water. This operation of redissolving and reprecipitating was repeated twice, and the precipitate was then strongly heated in a porcelain crucible to convert it into bismuth sesquioxide, and at the same time to volatilize any arsenic which might have been contained in the substance. Tests for arsenic and tellurium in the resulting sesquioxide failed to denote their presence.

The bismuth sesquioxide thus purified was administered to five persons under the same, and under different conditions as to dose and time. From 0·5 to 1·0 gram was given three times daily for six days. No garlic-like odor could be recognized in the breath.

To investigate the action of arsenic in the production of this odor in the breath, arsenious oxide was taken by myself, in doses of 0·003 gm. after each of the three daily meals for three days. On the fourth day, on account of the griping pain produced in the abdomen, and a violent

diarrhœa, only two doses were taken. There was not the slightest garlic-like odor perceptible in the breath.

Tellurium is comparatively rare, and is contained in many of the ores of bismuth. The mineral tetradymite contains as much as 49·79 per cent., Wehrlite, 29·74 per cent., and Joseite, 15·93 per cent. of the element. In a sample of metallic bismuth from Bolivia, Schneider[1] found 0·14 per cent. of tellurium. Brownen[2] found tellurium in the commercial bismuth oxynitrate, but it was not present in large quantity. On account of difficulties in its separation from bismuth, it often occurs as an impurity in the commercial bismuth oxynitrate, yet in most cases the quantity present is very minute. If more care were used in the preparation of the commercial oxynitrate, less would be heard of the so-called bismuth breath. Repeated precipitation and washing will entirely remove the obnoxious element.

As early as 1824 the odor produced by the ingestion of tellurium compounds was noticed by Gmelin.

In 1853 Hansen[3] investigated the cause of the production of the odor. This investigator experimented upon himself and a friend, and upon dogs, with potassium tellurite. This salt, in doses of 0·030 to 0·080 gm., taken by himself an hour before each meal, gave the garlic-like breath within a few minutes after the first dose, and this odor soon became so strong that he had to seclude himself from society. He continued the doses during seven days, his friend continued the doses for two days with similar effect, and noticed the odor in his breath for eight days afterward.

It is also stated that Wöhler, when investigating the volatile telluride of ethyl, noticed this same odor in his breath, and one night, when perspiring freely, the odor of the perspiration was almost unbearable. In the experiments on dogs the garlic-like breath was perceptible after one minute. Hansen quotes Gmelin as having in 1824 given tellurous acid to a dog and a rabbit. The rabbit only was killed, and on dissection gave off a garlic-like odor.

Sir J. Simpson[4] records a case in which a divinity student inadvertently swallowed a dose of tellurium, which was followed by the evolu-

[1] Jour. f. Prakt. Chem.
[2] Phar. Jour. Trans., Oct. 16th, 1875; Amer. Jour. Phar., 1876, p. 133.
[3] Liebig's Annalen, lxxxvi, p. 208.
[4] Blyth Manual of Chemistry, Lon., 1879.

tion of such persistent odor that for the remainder of the session the patient had to sit apart from his fellow students.

The experiments in this direction made upon several friends, and also upon myself are as follows:

Tellurous oxide (TeO_2) was prepared by treating metallic tellurium with nitric acid, evaporating to dryness and igniting the product. Some of the resulting tellurous oxide was taken by myself in doses of 0·005 gm. each. Three doses were taken on May 8, 1883, at 1, 4, and 7 o'clock P. M. In 15 minutes after the first dose the breath had a strong garlic-like odor, and in an hour a metallic taste was observed. An hour after the second dose the urine and sweat had the garlic-like odor, which was also observed in the fæces on May 12. The metallic taste was observed for 72 hours, and the garlic-like odor in the urine for 382 hours, in the sweat for 452 hours, in the fæces for 79 days, and in the breath it was still present, though very faintly, after 237 days.

In order to determine the smallest quantity of tellurous oxide which would be required to produce the garlic-like odor the following solutions were made:

I. 0·001 gm. of tellurous oxide was dissolved in potassium hydrate and sufficient distilled water to obtain 100 cubic centimeters. 5 cc. contain 0·00005 gm. tellurous oxide.

II. 0·00025 gm. of tellurous oxide was dissolved with the aid of a little hydrochloric acid in sufficient distilled water to make 100 cc. 5 cc. are equal to 0·0000125 gm. of tellurous oxide.

III. Made like the preceding, but diluted to 200 cc. 5 cc. are equal to 0·00000625 gm. tellurous oxide.

IV. 0·0001 gm. tellurous oxide, sufficient hydrochloric acid and water to measure 100 cc. 5 cc. are equal to 0·000005 gm. tellurous oxide.

V. Like the preceding, but diluted to 500 c.c. 5 cc. are equal to 0·000001 gm. tellurous oxide.

VI. 100 cc. of solution V was diluted with 100 cc. of distilled water; each cc. represents 0·0000001 gm. tellurous oxide.

These solutions were given to a number of young men; but no one was experimented upon a second time.

I. After one dose of 5 cc. of this solution, the garlic odor became perceptible in the breath in 35 minutes and lasted about 75 hours.

II. Three doses of 5 cc. each were taken after three succeeding

meals. The odor was noticed in the breath 30 minutes after taking the third dose, and continued about 66 hours.

III. Five doses of this solution of 5 cc. each were taken after five succeeding meals, when the odor was soon noticed, and lasted about 90 hours.

IV. After six doses of 5 cc. each, the odor was quite distinct; three additional doses were taken and the odor lasted 96 hours.

V. Five doses of 5 cc. each were taken after five consecutive meals; the odor was noticeable in 45 minutes and lasted 73 hours.

VI. After one dose of 5 cc. the garlic odor was perceptible in 75 minutes and lasted about 30 hours.

Smaller quantities of this solution were then given, namely, 1 cc. to each of two young men, 2 cc. to two persons and 3 cc. each to three persons; but no garlic like odor could be detected.

The nature of the compound which possesses this garlic-like odor is, as yet, not understood, although Hansen attributes the odor to be caused by a volatile organic compound of tellurium like the telluride of ethyl, which is given off by the lungs and skin. Both methyl and ethyl telluride have a garlic-like odor.

In this investigation the breath of myself which was exceedingly strongly impregnated with the garlic-like odor, was for several hours passed through a tall column of distilled water contained in a wash bottle, and the water afterward tested for compounds of tellurium, but not even a trace of this element could be found. However, from the minute quantity of the element which is required to produce this odor one would hardly expect to find by qualitative testing even the merest trace of the element in the breath. Necessarily, the presence of tellurium in such a minute quantity in the great majority of samples of the bismuth oxynitrate would prevent its detection by any of our chemical tests. From this failure to detect tellurium most likely have arisen the many statements[1] of its non-presence in the commercial bismuth oxynitrate. The physiological test seems to be the most delicate as has been shown, that in this way as little as 0·0000005 gm. or $\frac{1}{125000}$ of a grain of tellurous oxide equal to 0·0000004 gm. or $\frac{1}{166000}$ of a grain of the metal may be detected.

In these experiments idiosyncrasy seems not to have had any influence at all. Every one to whom the tellurium compound was administered in sufficient quantity was affected with the garlic-like odor.

[1] Dr. Squibb, Ephemeris, Sept. 1882.

DISPENSING BY DROPS.

By Albert Henry Kinsey, Ph.G.

Abstract from an Inaugural Essay.

The size of a drop generally depends upon and is influenced by at least four conditions.[1]

First: the self-attraction that the particles of liquids have for each other.

Second: its adhesion to the matter on which it is formed.

Third: the shape of this matter.

Fourth: the physical relations existing between the matter on which it is formed, the liquid constituting the drop itself, and the medium through which it passes.

In my experiments I have found that the greatest variance is caused by the third condition, viz.: the shape of the matter, to which may be added the amount of surface, as it is obvious that the more surface the greater will be the adhesion, and therefore will require more liquid to overcome this force, and consequently will produce a larger drop. This is practically illustrated below, when, in dropping from a glass stopper the surface from which the liquid has been dropped has a U-shape and is formed on the convex side, while from a minim measure it is dropped from the concave side of a $\vee$-shaped surface, giving the drop only a very small point to form on, and therefore must be much smaller. This is further illustrated in dropping from a glass stopper held at different angles. When held horizontally the drop is about twice the size of one dropped at an angle of 45 degrees. The difference is still greater when a common cork is taken, as it has a more acute angle. In the case of tincture of opium, the drop from a common cork, when held in a horizontal position, was more than twice as large as when held at an angle of 45 degrees.

Another very important feature in the matter of dropping is the rapidity with which it is done. It is a well-known fact that the less the interval between successive drops, the larger they will be. This interval has been called the growing time, and it follows that if this growing time is constant in the same liquid, the size of the drop will be the same.

[1] See also paper by Prof. C. F. Himes, in "Amer. Jour. Pharm.," p. 394, 1883.—Editor.

It has been shown by actual experiments, that when the growing time is decreased below 0·333 second (coco-nut oil was used in this instance) a continuous stream was the result, but of course the density of the liquid regulates this to a certain extent. It is also a curious fact that a stream so produced, delivers less in a given time than a series of large drops.

This rapidity of dropping is one of the greatest obstacles to overcome, for very few pharmacists will drop the same liquid in the same time, and if laws are to be laid down, governing dropping, the time certainly claims a large share of attention, for the same mistake is just as likely if not more so, to happen in this instance than in the previous one, for a pharmacist who dispenses 100 drops of a liquid at the rate of three drops a second, will give one half as much again as another who measures the same liquid at the rate of a drop every second and one half.

Prof. Guthrie has shown the effect of gradually decreasing the strength of saline solutions. Dropping, at the rate of two seconds, he found that decrease of solid constituents produced precisely the same effect upon the size of the drops, as a decrease in the growth rate in the drops of homogenous liquids. I find that these facts, however, have their greatest importance from a theoretical point of view, practically there is very little, if any, difference, although in some instances it does seem as though the matter in solution might be the cause of the decrease in size by increasing its specific gravity. The following table gives the result of my experiments, having chosen the glass stopper, minim measure and lip of the bottle in which the liquids are ordinarily kept, to drop from.

By comparing my table with those of Prof. Procter or Mr. Durand, it will be noticed, in a number of instances, that they vary very widely, about the only way I can account for this is, that the lip of the minim measure, which I used, must have been much smaller than theirs, but even when the same vessels are used, there is such a variety of results, that to get a medium size an average is required to be taken. This I have done in all of the unimportant liquids. How greatly they vary may be seen in the case of Acetum opii; in the first trial the result was 120 drops to a drachm, the second 85, and the third 103.

There are still other conditions which yield more or less influence on the size, and one which deserves mention, is the angle at which the vessel is held. I have already shown that a cork may be held so a

Preparation.	Shop bottle.	Glass stopper.	Minim measure.
Acetum Lobeliæ	51	48	64
" Opii	66	57	65
" Sanguinariæ	102	92	92
Acid. Acetic	82	49	101
" " Dilute	94	55	99
" Carbolic	82	66	110
" Hydrobromic	57	65	70
" Hydrochloric	60	57	96
" " Dilute	70	51	62
" Nitric	82	66	124
" " Dilute	63	60	81
" Nitrohydrochloric	87	74	92
" " Dilute	58	54	62
" Phosphoric., "	54	43	62
" Sulphuric	160	152	172
" " Dilute.	57	47	60
" Sulph. Arom	97	94	144
Aqua Ammoniæ	45	41	54
" Destillata	64	.....	61
Liquor Potass. Arsen	58	61	77
Oleum Anisi	76	73	112
" Amygdalæ Am	102	77	125
" Cari	108	84	133
" Chenopodii	94	75	129
" Caryophylli	98	75	133
" Cinnamomi	77	73	112
" Crotonis	84	62	104
" Cubebæ	86	80	120
" Gaultheriæ	93	93	136
" Hedeomæ	95	83	130
" Lavandulæ	105	78	133
" Monardæ	82	76	125
" Menthæ Pip	88	73	132
" " Viridis	95	81	132
" Myristicæ	98	83	128
" Origani	91	83	133
" Pimentæ	102	86	133
" Rosmarini	92	88	133
" Sassafras	83	77	142
" Tanaceti	110	91	136
" Terebinthinæ	103	90	142
Spiritus Ammon. Ar	108	87	139
" Camphoræ	98	79	140
" Æther. Comp	120	88	140
" " Nit	88	86	144
" Menthæ Pip	98	86	143
Syrupus Scillæ Comp	106	87	122
Tinctura Aconiti	120	102	164
" Asafœtidæ	102	85	145
" Belladonnæ	94	81	128
" Benzoini Co	98	81	146
" Cannabis Ind	124	120	98
" Cantharidis	118	97	136
" Capsici	116	88	143
" Colchici	86	80	124
" Digitalis	114	79	145
" Ferri Chlor	108	.....	139
" Hyoscyami	114	91	147
" Ignatiæ	112	83	140
" Iodi	112	97	144
" Kino	116	100	148
" Krameriæ	117	96	150
" Lavand. Co	97	86	141
" Lobeliæ	110	79	138
" Myrrhæ	100	95	145
" Nucis Vomicæ	112	105	148
" Opii	98	92	143
" " Camph	94	86	135
" " Deodor	109	89	141
" Rhei	98	82	144
" Sanguinariæ	110	88	134
" Serpentariæ	98	89	146
" Stramonii	100	93	120
" Tolutana	120	97	156
" Veratri Virid	108	98	152
Vinum Aloes	71	54	94
" Colchici Rad	92	72	95
" " Sem	86	71	105
" Ergotæ	148	99	122
" Opii	96	72	102

drop can be obtained twice as large as another where the cork has been held at a different angle, the same is true with a bottle, but not quite in so great a degree.

The fulness of the bottle also exerts some influence, as tincture of aconite, when dropped from an ounce vial full, yielded 110 drops to the drachm, but when only one-fourth full gave 116 drops, also liquor potassii arsenitis, from a full ounce vial, gave 66 drops, and when one-third full, only 57. In the one case, decrease in the amount of liquid decreased the size, while in the other it was increased. The drop from an ounce vial was in most instances the same as from the shop bottle.

By a careful perusal of the above we can readily notice that the different classes of preparations can be grouped together, as for instance, the tinctures or alcoholic preparations may be classed as a group, whose drops are about one half the size of the aqueous liquids, while the oils and acids form an intermediate group between the two. Durand must have taken notice of this fact, when he laid down his two general rules concerning drops as follows:

First: that liquids, with a small proportion of water, afford a small drop, and vice versa.

Second: that amongst liquids containing a large proportion of water, those not charged with remedial substances, give a larger drop than those same liquids having extraneous bodies in solution.

In summing up my labors on this subject, there is only one general conclusion that I will mention, as it covers all of the others, and if properly heeded may be the means of saving considerable trouble, and I might say is also in harmony with those who before me have given the subject a still more thorough investigation. Having shown that the same liquid under different and even the same circumstances, varies in dropping so much, that no reliance whatever can be placed in this method of dispensing medicines, therefore their administration in this form is always attended with more or less danger.

Iodine, Salicylic Acid and Sodium Salicylate, according to Dr. Ritten, when applied to the skin either as simple solution, or as spray or in the form of ointment are not absorbed until after the normal skin has been altered by these irritants.—*Arch. f. Klin. Med.* xxxiv, p. 143.

ON THE PRESENCE OF PIPITZAHOIC ACID

IN THE PEREZIAS FOUND IN THE TERRITORY OF THE UNITED STATES, AND ON THE GEOGRAPHICAL DISTRIBUTION OF THE NORTH AMERICAN SPECIES OF THAT GENUS.

By CHARLES MOHR, Mobile, Ala.

Translated by the Author from Pharmaceutische Rundshau.

The remarks on pipitzahoic acid which appeared in the "Rundschau" of November has directed the attention of the writer anew to a subject in which he felt himself greatly interested during his stay in Mexico in 1857, where he got acquainted with the publication of the researches of Rio de la Lozas, announcing his discovery of this peculiar organic acid, made a short time before. The inquiries after its source, the "*Raiz del Pipitzahuac*," made in consequence at the time in the leading drug houses of the city of Vera Cruz and at Orizava were leading to no results. Amongst the varied stock of the numerous drugs derived from Mexican plants no root was found of that name, and only a single species of Perezia was encountered during the frequent botanical excursions made in these parts of the Mexican republic, also the only one found amongst the large collection made by the botanist Bolteri, of Orizava. After a lapse of many years the determination of this plant was only made possible a few weeks ago, since the review of the North American Perezias by Prof. Gray has come to hand, where it is described under the name of Perezia Dugesii.[1]

These plants seem to shun the damp clime of the eastern declivity of the Mexican Andes; they are rather plants of the desert regions, finding their proper home, with the widest distribution, in the rainless, arid plains (mesas), and on the rocky hills of the highlands of northern Mexico and the adjoining parts of the United States.

The genus Perezia, Lag., as defined by Gray,[2] embraces bilabiate compositæ of the sub-order Labiatifloræ and the tribe Mutisiaceæ, with perfect and throughout homogeneous flowers, united to a greater or lesser number in heads with a naked receptacle, surrounded by a campanulate or top-shaped involucrum of stiff elongated more or less lanceolate scales, imbricated in two or more rows. Corolla with a

[1] Gray, "Proceed. Am. Acad. Arts and Sciences," vol. xix, Oct., 1883.
[2] Gray, *loc. cit.*, and Botany of California, vol. 1.

slender tube, distinctly two-lipped, with the three-toothed exterior lip longer than the interior, with two teeth; the anthers are long caudate, with a more or less prominent lanceolate tip or crest-like appendage. The akenes are elongated cylindrical or slightly angled, often somewhat spindle-shaped, with a discoid apex, bearing a pappus of copious capillary, somewhat scabrous bristles. All the species are perennials, with more or less rigid leaves, with the simple stem bearing the white or purplish flowers in solitary heads or in corymbs. They are exclusively confined to the warmer parts of the American continent, and the 40 or 50 species known are equally divided between its southern and northern divisions. Those occurring in the latter are found in the highlands of Mexico and the adjacent parts of Central America, extending beyond the Mexican border into the territory of the United States as far north as the 34° of north latitude.

The North American species belong all to a group distinguished by the similarity of all the florets within one head, the three-toothed exterior lip of the corolla being even in the marginal flowers, scarcely if at all longer than the interior, forming the well-marked natural section Acourtia, established first as a proper genus by De Candolle. In the group embracing the South American species, the Perezias proper, found mostly south of the Equator, the interior lip of the corolla is considerably shorter than the ligulate exterior. For the establishment of the characters of the species belonging to the first of these groups, and for the determination of the limits of their distribution, we are indebted to Prof. Gray, who has particularly given many years of his arduous labors to the elucidation of the most prominent feature of the North American flora, the difficult order of Compositæ, with such eminent and distinguished success. The characters of these plants were before but vaguely defined, and variously understood; hence we find them referred to various genera; some were described under the genus Dumerilia, Less., others as species of Trixis and Proustia, section Thelecarpus and Acourtia, D. C. Of the 24 North American species recognized by Gray seven are found within the southwestern territory of the United States; they were mostly brought to light during later years by the explorations of the arid regions between southwestern Texas and the Pacific Ocean. The first five of the species enumerated below, the flora of the United States has in common with northern Mexico, and the two following seem to be confined to its limits.

Species found in the United States.

1. Perezia nana, Gr., Pl. Trendler 110, and Plant. Wright., i, 125, seems to be the most frequent, being found in all the collections made in Southwestern Texas, Southern New Mexico, all parts of Arizona and the adjacent parts of Mexico.

2. Perezia runcinata, Lag., from Chihuahua and Sonora to Arizona, and New Mexico as far east as the Colorado river in Texas, where it is not rare on the rocky hills near Austin.

3. Perezia Thurberi, Gr., Pl. Thurb., Sonora, Southern Arizona.

4. Perezia Wrightii, Gr., Plantæ Wrightianæ,—*P. arizonica*, Gr., Flor. Cal., not rare from Southwestern Texas and Southern Utah through Arizona to San Louis Potosi (Schaffner).

5. Perezia Parryii, Gr., Proc. Am. Acad. Sci. and Art, vol. xv. Southern Arizona.

6. Perezia Wislizeni, Gr., Plant. Fendl. Southern New Mexico.

7. Perezia microcephala, Gr., Acourtia microcephala, D. C. Coast of Southern California (Santa Barbara, Monterey).

Species of Northern Mexico.

8. Perezia formosa, Gr., P. turbinata, Gr., Pl. Wright., non Llav. et Lex. Acourtia formosa, Don. A. macrocephala and Trixis turbinata, Schultz Bip. Leg. Seemann.

9. Perezia thyrsoidea, Gr. Bot. Mexic. Bound. Surv., leg. Berland.

10. Perezia Seemannii, Gr. Pl. Wright., leg. Seem. Northwestern.

11. Perezia Coulteri, Gray. Proc. Am. Acad. xv. Leg. Coult.

12. Perezia patens, Gr. Acourtia formosa and Trixis patens, Schultz Bip.

13. Perezia platyphylla, Gr. Fendler, leg. Coulter, Zimapam.

14. Perezia rigida, Pl. Gr. Pl. Wright. l. c. Acourtia rigida, D. C. A. formosa, Hook. et Arn.

Species of Central Mexico.

15. Perezia adnata, Gray. This is the mother plant of the Raiz del Pipitzahuac of the natives, brought first to the notice of European botanists by Schaffner, who collected the plant near Tolucca. Trixis Pipitzahuac, Schaffner et Schultz Bip., Dumerilia Alami, D. C. Perezia Alami, Hemsia Biol. of Central Americ., Bot. ii. Morelia legit Giesbrecht.

16. Perezia hebeclada, Pl. Wright. Acourtia hebeclada, D. C.

17. Perezia turbinata, Llav. et Lex. Valley of Mexico, legit Schaffner.

Species of Eastern and Southern Mexico.

18. Perezia oxylepis, Gr. Proceed. Am. Acad., xv. Puebla? Liebman.

19. Perezia carpholepis, Gr. Acourtia carpholepis, Schultz Bip. Liebman.

20. Perezia Dugesii, Gray. Proc. Am. Acad., xix., Guanaxuato Duges leg. Acourtia spec. Plant. Botteriana, 1172. Orizava. Botteri, Mohr legit 1857.

21. Perezia moschata, Llav. et Lex. Chiapas, Giesbrecht.

22. Perezia reticulata, Gr. Proustia reticulata, Lag. Dumerilia reticulata, Don. From the Valley of Mexico to Oaxaca, Galeotti.

23. Perezia fruticosa Llav. et Lex. A dubious species.

24. Perezia nudicaulis, Gray. Plant. Wright. Republic Guatemala, Skinner.

Of the species occurring in the United States, the writer has obtained specimens of two species, Perezia nana and Perezia Wrightii, for which he is indebted to the kindness of Messrs. Lemmon and Pringle, zealous botanists who have spent the past season in the botanical exploration of Arizona and Southern California. The roots attached to several specimens furnished sufficient material to establish the presence of pipitzahoic acid, and the specimens of great perfection served as originals for the accompanying illustrations of these most interesting plants.

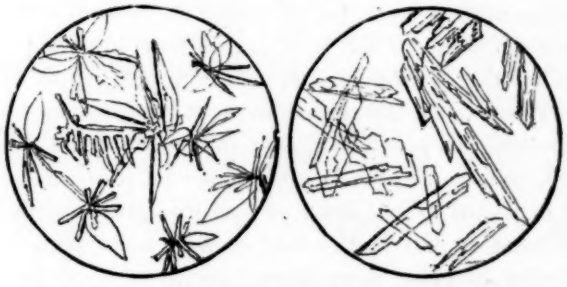
Perezia nana Gr., of slender growth from 4 to 8 inches high, with a slender, creeping or ascending root-stock, articulated mostly, and the joints and head of which are covered with tufts of fine woolly hairs. The slender wiry stem is simple or sparsely branched from the base, slightly flexuous, angled and a little rough. The rigid, coriaceous leaves are shining, glandular, scabrous, strongly reticulate veined, roundish ovate, 1½ to 2 inches wide and but little longer, spinose toothed, sessile by a cordate base or amplexicaul. The large capitula are terminal, subsessile, 20–30 flowered with a campanulate involucre of mucronate cuspidate, ciliated scales, arranged in three rows, of which the exterior ones are ovate and the interior lanceolate, all purplish

Perezia (Acourtia) nana, *Gray* (natural size).—1. Corolla. 2. Stamens. 3. Akene (magnified). 4. Floret (natural size).

Perezia (Acourtia) Wrightii, *Gray*.—1. Leaf (nat. size). 2. Flower head (nat. size), with bases of cut pedicels. 3. Root (½ nat. size). 4. Root deprived of the woolly covering. 5. Floret (nat. size). 6. Corolla. 7. Akene. 8. Stamens (magnified).

towards the apex. The akenes are whitish, glandular, puberulent, cylindrical, and have a pappus of copious hairs.

The root of a slightly bitter and astringent taste, imparts to strong alcohol a dingy yellow tint, which by the addition of a weak solution of a caustic alkali deepens to a clear deep yellow color. If a very dilute solution of sodic or potassic hydrate is carefully added, a faint and evanescent tint of impure purple color is perceptible, indicating the presence of small quantities of pipitzahoic acid combined with another substance. As would be expected by the deepening of the color, in consequence of the addition of an alkali to the tincture, this substance proved to be a tannic acid, ferric chloride producing an abundant precipitate of dark green color, which disappeared by the addition of oxalic acid. To obtain the pipitzahoic acid pure, the alcoholic tincture of the root was treated with boiling water, and the very minute quantity of a golden yellow crystalline precipitate washed by decantation. Examined under the microscope it was seen to form stellate groups of acicular or dagger-shaped golden yellow crystals characteristic to this compound, which by the addition of a drop of diluted solution of sodic hydrate are dissolved with the production of a beautiful deep violet color. Incomplete as the chemical investigation of the few decigrams of the root of this plant at command must appear, its results show that as a source of pipitzahoic acid, it is of but little value, which in reference to the therapeutical virtues claimed for this substance as a mild purgative, is further impaired by the largely predominating quantities of tannic acid with which it is associated. Of greater interest, in that respect, containing considerable quantities of pipitzahoic acid in an almost pure state, was found the following species:



Crystals of pipitzahoic acid, magn. 160 diam.

Prepared by precipitating the alcoholic solution with water.

By evaporating the alcoholic tincture of the root.

Perezia Wrightii, Gr. This is a robust plant from 1 to 2 feet in height, with a woody tap root on all sides covered by a dense cushion of long silky dark brown hairs; freed from these, it is found more or less contorted, over an inch long and $\frac{3}{8}$ of an inch in thickness. The transverse section shows, when examined under the microscope, numerous fibro-vascular bundles, separated by the intervening cortical substance. Stem erect, simple below, corymbosely branched above, smoothish, the lower part covered by the leaves which are membranaceous, 3 to 4 inches long, 2 to 3 inches broad, glabrous, strongly ribbed, unequally serrated and spinulose denticulate, closely sessile, with an auriculate or cordate base. Flowering heads numerous, small, with short, glandular hairy, subulately bracted pedicels, terminating in dense clusters the branches of the open, nearly naked corymb, containing 8 to 10 flowers. Involucre small, scarcely exceeding, in length, the fruit; the scales to the number of 12 to 15, are rather membranaceous, greenish, viscid puberulent, the innermost oblong linear, the exterior shorter, oblong-ovate. Akenes 5 ribbed, somewhat fusiform, bearing a pappus of copious, soft, white, capillary bristles.

The root is of a bitterish, not disagreeable taste. The alcoholic extract is of a pure deep yellow color; treated with an excess of boiling water it yields an abundant crystalline, golden yellow precipitate of pipitzahoic acid, which, by the addition of a dilute solution of caustic alkali shows the characteristic splendid reaction already described. From these observations it is evident that the roots of Perezia Wrightii will serve as a fit material for the preparation of this acid in larger quantities.

According to Prof. Gray,[1] Perezia runcinata possesses thick, tuberous roots similar to those of the dahlia. Unfortunately I could not procure specimens of this plant, found nearest to the limits of our eastern North American flora. I am, however, in hope to obtain them before the close of another season, as well as a sufficient supply of the roots of Perezia Wrightii for the preparation of larger quantities of this highly interesting and peculiar organic constituent of the North American Perezias, so as to be able to study closer its properties, and obtain some light in regard to the uses to which it might possibly be applied to in the laboratory and in the arts, as well as to permit of a closer investigation of its value as a remedial agent.

Mobile, December, 1883.

[1] Rep. Mexic. Bound. Sur. Botany.

PIPITZAHOIC ACID OR VEGETABLE GOLD.

By Thomas Greenish, F.C.S.

The author refers to the root and the acid exhibited by Mr. Vigener, of Bieberich, at the meeting of the German Apotheker Verein, in 1883; among the specimens of acid was one in fine flakes, the result of sublimation, and of a brilliant golden yellow color, hence the name "vegetable gold" applied to this product. The drug was first noticed in Europe in 1855, when Dr. Schaffner, a young German pharmacist, obtained of Dr. Leopold Rio de la Loza, Professor of Chemistry and Pharmacy in Mexico, a sample of the acid, which was subsequently analyzed by M. C. Weld ("Annal. Chem. Pharm.," xcv, 188).[1] In his report on the chemical and pharmaceutical products in the Philadelphia Exhibition, Mr. J. R. Jackson mentions pipitzahoic acid and pipitzahuina and briefly describes the former.[2]

The author then gives the following description of specimens presented by Mr. Vigener:

The roots, as furnished me, were in pieces from 8 to 10 cm. long and 2 mm. thick, externally of a brown or reddish brown color, more or less furrowed longitudinally on the surface, apparently through the shrinking of the root in the process of drying; its taste was decidedly bitter, leaving a pungency on the tongue which remained after the bitterness had passed off, and this pungency was somewhat persistent.

In a transverse section of the root the yellow spots of pipitzahoic acid were visible to the naked eye, and more distinctly seen in their relation to the other parts when the section was slightly magnified with a lens. The outer cortical layer consists of a double row of thickened tabular cells, tangentially disposed and deeply colored; this is followed by a layer, several cells deep, of collenchymatous tissue passing inward to the fundamental parenchyma of the root. The

[1] A notice of the drug is also contained in "Compt. Rend," xlii, 873, 1072. Ramon de la Sagra refers the root to Dumerilia (Perezia, *Gray*) Humboldtii, *Lessing*, and describes the product as riolozinic acid.—Editor Amer. Jour. Phar.

[2] The Mexican Catalogue of the Exhibition of 1876 gives the following information:

Trixis Pipitzahoac, *Schaffner*, "Pipitzahoac." In the valley of Mexico and in the western mountains. The rhizomes and roots contain a resinous substance, which Mr. L. Rio de la Loza has called *pipitzoic acid*. It is used as a drastic in a dose of from 4 to 8 grains.—Editor Am. Jour. Phar.

pipitzahoic acid is contained in secreting cells, in groups of from three to five; the acid is in yellow lumps of a crystalline structure. These depositories of the acid, striking in the entire section, are arranged in a circle and correspond to the fibrovascular bundles. Stellate spots are scattered throughout the fundamental tissue from the collenchyma to the centre of the root and are due to certain cells only of the tissue becoming thickened by secondary deposit, and converted into sclerenchymatous or stone cells with laminated structure, the intercellular spaces being filled with a dark colored deposit. These cells are found mostly single, but occasionally in groups of two, three or more. A longitudinal section shows, in addition to the relative positions of the cells referred to, the more characteristic constituents of the root as pipitzahoic acid, and the dark deposit around the long stone cell traversing the length of the root.

Most of the parenchymatous cells contain grains of inulin, *Perezia* being one of the Compositæ, and containing inulin as the equivalent of starch present in the plants of other orders.

This brief account of the microscopical structure of the Perezia root will serve to make the more salient features in its histology intelligible. The quantity of root placed at my disposal was only 2 gm., and that of acid 0·33 gm.; it must, therefore, be obvious that few experiments beyond those afforded by micro-chemistry could be undertaken.

A transverse section of the root in which the lumps of pipitzahoic acid were visible were subjected to micro-sublimation on a microscopic glass slide, and at a little over 100°C. the acid sublimed on the cover-glass in yellow crystals. An alcoholic tincture of the root, yellow from solution of the acid, brought into contact with a dilute solution of caustic alkali or alkaline carbonate, developed that fine purple color which induced Herr Vigener to suggest a probable future for the acid as a color indicator in chemical investigations. The tincture on evaporation yielded crystals of pipitzahoic acid.

I was unable to satisfy myself as to the character of the intercellular dark deposit. It was not affected by alcohol, ether, benzol, chloroform or turpentine; neither did caustic alkali dissolve it; it was decomposed by nitric acid. If from the negative results of these experiments I may be allowed to offer an opinion, it would be that the deposit in question is dried latex.

When the pipitzahoic acid first came under my notice it occurred to me as probable that its formation might be due to a degradation of

tissue and a rearrangement of its elements similar to that which takes place in araroba or goa powder; but a careful anatomical investigation does not support that view. It appears to be a true secretion in certain cells occupying the same relative position throughout the root, and unaccompanied by any of that breaking down of the surrounding cells so marked in the microscopical investigation of araroba.

The *Perezia* may prove a valuable medicinal plant, but to determine that point there are yet wanting those careful therapeutic investigations which should precede the appearance in general practice of any new drug, a series of well conducted experiments which very few seem capable of conducting, and for the results of which still fewer have the patience to wait.—*Phar. Jour. and Trans.*, March 1, 1884.

ON KEPHIR.

By Professor H. Struve.

Translated from Berichte d. Deutschen Chemischen Gesellschaft, 1884, p. 314–316.

Kephir is a beverage which is prepared by a peculiar process of fermentation from the milk of cows and other animals. It has been in use from time immemorial by the inhabitants of the northern declivities of the high Caucasian mountain range, to whom it possesses the same importance as koumis does to the nomades of the southeastern steppes of Russia. The last-named beverage was for the first time brought to the notice of the scientific world in 1784, and since then it has been frequently the subject of investigations, but only within a few decades has it attained greater importance as a remedy.

On the other hand, kephir was, even in Russia, totally unknown until two years ago, although in 1867 Dr. Sipowitsh had made a short communication on this subject to the Caucasian Medical Society, which remained buried in the archives of the latter. Ten years later, in 1877, Dr. Shublowski published a more detailed paper on kephir which, however, failed to direct the attention of science or that of the public towards this new beverage; the proper impulse was first given from Moscow in 1881, almost a century after the first notice of koumis.

On December 1st, 1881, Ed. Kern read a paper before the Imperial Society of Naturalists at Moscow ("Bull. Soc. Impér. des Natur. de Moscou," 1881, p. 141) on "Kephir, a new milk ferment from the

Caucasus," which he had collected during his travels. The requisite investigations had been made by Ed. Kern under the supervision and in the laboratory of Prof. Goroshaukin. The result is that, within the last two years, kephir was not only introduced as a medicine from the southern to the northern section of Russia; but that also a number of papers and pamphlets on this subject has been published. During the latter part of the past year kephir has also been noticed in other countries, among others by Prof. Dr. F. Cahn, at the meeting held December 13, by the section for Natural Sciences of the Silesian Society at Breslau. Kephir has already become an article of speculation, is procurable in commerce, and will doubtless be further scientifically investigated. The narrow circle in which for centuries kephir has been harbored with almost religious piety, has been broken, and it has become public property notwithstanding the method of its preparation is still surrounded with a certain mystery, depending upon the so-called kephir-grains, the new milk ferment of Kern. This can only be procured from the mountain tribes; but after it has been obtained, kephir may be prepared with the requisite precautions, at all times, in winter or in summer.

This present mystery concerning the origin and nature of the kephir-ferment invites further investigations, and it will doubtless not be a long time before the preparation of kephir in all its details will have been ranged with the known phenomena of fermentation in general. Then, most likely, this simple beverage and remedy of the mountain tribes of the high Caucasus will be accorded an important position among the domestic and general remedies, more particularly as towards koumis. But years of observation will be required to determine its true value; at present kephir is beginning to become a fashion remedy.

The author has undertaken the chemical investigation of kephir with the view of applying to it the results of his protracted investigations of milk, and of determining the changes produced by this ferment; although more difficult and complicated than expected, he hopes in the near future to be able to report his results.

Tiflis, January 30, 1884.

Antibacterid, an antiseptic patented in Germany, is prepared from 338 parts of borax, 124 parts of boric acid and 198 parts of glucose, dissolved in a little water; the solution is evaporated until a solid mass is left.

RELATIVE ABSORPTION OF NEUTRAL SALTS IN THE HUMAN STOMACH.

By W. Jaworski.

These experiments were carried out under normal physiological conditions in a healthy man who drank the solutions (500 cc.) of chemically pure salts and remained at rest until the residual fluid was recovered from the stomach by means of an aspirating pump specially devised for the purpose. This was then submitted to analysis, and the changes in the percentage of the salts determined.

These investigations showed that in the human stomach the absorption of individual salts is different, and dependent upon their chemical composition.

The acid carbonates (magnesium and sodium) underwent the greatest, the chlorides (magnesium, potassium, sodium, and ferric) the least absorption, and the sulphates (sodium and magnesium) between these extremes.

The difference in the absorption of two salts is the greater the longer the solution is present in the stomach.

The presence of acids in the stomach hastens absorption, and the difference in the absorption of individual salts becomes more pronounced. Carbonic acid especially accelerates absorption, which, on the other hand, is hindered by alkalinity of the contents of the stomach.

The presence of common salt neither accelerates absorption nor increases the gastric secretion; the action is negative in both directions.

The secretion of chlorine is greater in proportion to the alkalinity of the saline solution and the length of time the latter remains in the stomach. Acid sodium carbonate excites the secretion of the gastric mucous membrane less than the neutral carbonate.

When distilled water is introduced into the stomach, secretion of acid contents (hydrochloric acid) ensues, and that in proportion to the lowness of its temperature.

Should a salt undergo dissociation of its acid and base in the stomach, these are not absorbed in the ratio of their combining proportions. Saline solutions may be found on aspiration still present in the stomach an hour after their introduction, whereas the same quantity of distilled water disappears almost entirely within half an hour

afterwards. From these results certain practical suggestions of clinical importance may be derived.

In the first place the administration of salts in the form of acid carbonates, as with an excess of carbonic acid, is advantageous, for absorption takes place more quickly, and with a more rapid emptying of the stomach there is less irritation of its mucous membrane. The author observed the action of CO_2 and of the acid carbonates, as also of CaH_2CO_3 in a series of experiments with acidulous mineral waters.

Alkaline fluids, on the other hand, delay absorption and the evacuation of the stomach, and the gastric walls are stimulated to secretion more strongly than by other solutions. Acids favor absorption and rapid evacuation of the gastric contents.

The presence of common salt in the stomach does not appear to offer the advantages in regard to digestion which have heretofore been ascribed to it, neither stimulating to greater excretion of the gastric acid (this remark may perhaps not apply to pepsin) nor to evacuation of its contents. In the moderation of the activity of the gastric walls by alkaline agents may probably be found an explanation of the therapeutic results of certain remedies, such as magnesium carbonate, sodium carbonate, and certain metallic oxides, in relieving the pain of cardialgia.

The introduction of salts in the form of chlorides in neutral solution is, as regards gastric absorption, not advantageous, and still less so in the case of neutral carbonates, which are absorbed only in proportion as their transformation into chlorides takes place.

The difficult absorptivity of ferrous chlorides is especially to be noted from a medical point of view, and considering the facility of absorption of acid carbonates, it may be assumed that an acid ferrous carbonate would prove the most absorbable of all iron preparations.—*Jour. Chem. Soc.*, Feb., 1884; *Zeitschr. Biol.*, xix, 397–445.

Combination of Morphine with Acids in Opium.—D. B. Dott states that an aqueous extract of opium contains sulphuric acid sufficient, and meconic acid insufficient to combine with the whole of the morphine present; but it contains also inorganic and organic bases with which the sulphuric acid will unite in preference to the morphine, the remainder of this acid being not sufficient to combine with all the morphine. This alkaloid, therefore, exists in opium both as sulphate and meconate, possibly as acid meconate.—*Phar. Jour. and Trans.*, November 17, 1883, pp. 389, 390.

THE PREPARATION OF A STANDARD EXTRACT OF NUX VOMICA.[1]

By Wyndham R. Dunstan,

Assistant Lecturer in Chemistry and Physics to the Pharmaceutical Society and Demonstrator of Practical Chemistry in the School of Pharmacy; and

F. W. Short,

Assistant Demonstrator of Practical Chemistry in the School of Pharmacy.

In previous communications to this Society and to the British Pharmaceutical Conference we have described the results of a chemical investigation of *Strychnos Nux vomica* and its pharmaceutical preparations. Processes for the estimation of the total alkaloid in the nux vomica seeds, in the tincture and in the extract have been devised, and a method for the quantitative separation of strychnine and brucine has been proposed. At the last meeting of this Society the results of some experiments were communicated relative to the extractive power of alcohol of various degrees of dilution for the alkaloidal salts which are contained in nux vomica. Now our analyses of authentic and commercial specimens of nux vomica have shown that different specimens vary very considerably in alkaloidal content, and a very serious want of alkaloidal uniformity has been shown to obtain in the instance of commercial tinctures and extracts of nux vomica. In the present papers it is intended to apply the results of the above investigation in the preparation of a standard extract and tincture of nux vomica, that is, an extract and tincture of nux vomica which shall contain a definite and constant quantity of total alkaloid. Perhaps the most obvious method of attaining such a result would be in the first place to obtain a specimen of nux vomica which contained a known percentage of total alkaloid, and completely to exhaust a certain weight with a definite volume of alcohol. There are, however, certain practical difficulties connected with the complete exhaustion of nux vomica by a definite volume of spirit, and still greater difficulties in obtaining nux vomica constant in percentage of alkaloid, that led us to work upon somewhat different lines.

It is proposed at the outset to take a good commercial specimen of nux vomica in powder. We have previously shown that the powdered nux vomica at present in commerce is free from adulteration, and hence this substance can be used with advantage for the present pur-

[1] Read at an Evening Meeting of the Pharmaceutical Society, Feb. 6, 1884.

pose. In case of a necessity arising for obtaining nux vomica seeds in fine powder it should be noted that we have in a previous paper given a method for easily effecting this (*Phar. Jour.*, [3], xiii., 1053). Commercial specimens of nux vomica contain, on an average, 3 per cent. of total alkaloid. The seeds having been obtained in a fine state of division they are extracted by percolation with a definite volume of alcohol of specified strength. The percolate is then measured and the quantity of total alkaloid is estimated in a given volume of it. The volume of this percolate, which contains a quantity of alkaloid corresponding to the percentage of alkaloid which should be present in the extract is then taken and evaporated to a definite weight. We have fixed 15 per cent. as the quantity of total alkaloid which shall be contained in the standard extract of nux vomica; this decision is based upon a careful consideration of the results of our analysis of the extracts of nux vomica which are now used in medicine, which results were communicated at the last meeting of this Society.

It will be necessary now to consider some important practical questions connected with the actual preparation of the extract. It cannot, in the first instance, be too strongly insisted that the seeds should be in a very fine and uniform state of division, for unless this is the case, thorough and uniform extraction is impossible. In the extraction of the seeds we recommend the employment of a dilute alcohol, made by adding 25 volumes of water to 100 volumes of rectified spirit, for we have previously shown that alcohol of this strength has the highest solvent power for the alkaloidal salts which are contained in nux vomica. Extract of nux vomica is usually made by boiling the nux vomica with alcohol until exhausted; but it seemed to us that if the nux vomica could be exhausted with a comparatively small quantity of spirit without the aid of heat there would be a distinct advantage, especially in the manufacture upon the small scale. Experiments were therefore made in this direction. Thirty grams of nux vomica in impalpable powder were packed in a stoppered percolator, mixed with 60 cubic centimetres of alcohol (100:25), and allowed to macerate for twelve hours. Percolation was then commenced, and when it had ceased an additional 60 cubic centimetres of the alcohol were poured upon the marc. When this had ceased to pass through the percolate measured 80 cubic centimetres. Sixteen cubic centimetres were analyzed by the process which has been previously described (*Pharm. Jour.* [3], xiv. 441), and it was found that the 80 cubic centimetres of

alcohol had extracted 0·735 gram of alkaloid. A portion of the specimen of nux vomica employed had been previously assayed and found to contain 2·66 per cent of total alkaloid; 30 grams consequently contained 0·8 gram of total alkaloid, so that 92 per cent. of the total alkaloid had been extracted by the 80 cubic centimetres of alcohol. To the marc were now added another 60 cubic centimetres of the alcohol; the percolate was analyzed and found to contain 0·041 of alkaloid, making a total of 0·775 gram of total alkaloid extracted from 30 grams of nux vomica, which contained 0·8 gram of total alkaloid.

These experiments were now repeated upon a larger scale, and the quantity of extract as well as of total alkaloid was estimated in each successive fraction of the percolate. One pound of finely powdered nux vomica was intimately mixed with one pint of alcohol (100 : 25) and allowed to macerate for twelve hours. Percolation was then commenced and continued with more alcohol, portions of the successive fractions of the percolate being assayed for total alkaloid. A total quantity of four pints of alcohol was employed. The results were as follows:

One pound of nux vomica, containing 189 grains of total alkaloid, was extracted with 4 pints of dilute alcohol (100 : 25).

Fractions of percolate.	Volume of fraction.	Amount of extract containing 22·67 per cent. of moisture.	Amount of total alkaloid (strychnine and brucine)
First fraction	26 ounces	856 grains	125 grains
Second fraction	16 ounces	220 grains	32 grains
Third fraction	10 ounces	74 grains	11 grains
Fourth fraction	10 ounces	29 grains	3 grains
Total percolate	62 ounces	1,179 grains	171 grains

These results show that, proceeding in the above way, nux vomica is practically exhausted by four times its weight of alcohol of the specified strength. It will be noticed that maceration and percolation were adopted, principally because it was found that the first fraction of the tincture made by direct percolation deposited, after a short time, a flocculent precipitate that was not permanently redissolved by heat. No such result occurred when maceration was adopted, although the strong tincture if kept for some time, especially in cold weather,

deposits a substance which is apparently a fatty acid, and consequently contains no strychnine or brucine, and by gently heating is permanently redissolved. It now remained to prepare the extract from this strong tincture in which the amount of alkaloid was known. After a number of preliminary experiments it was found that 9 ounces (fluid) of this strong tincture, containing 10 grains of total alkaloid, were converted into an extract of suitable consistence by evaporating upon the water-bath until the product weighed 66·6 grains; that is, contained 15 per cent. of total alkaloid. In order to confirm the calculated alkaloidal content of this extract 1 gram was assayed and yielded 0·151 gram of total alkaloid, thus agreeing admirably with the calculated percentage (15 per cent.). We then prepared this standard extract from different specimens of nux vomica, representing high and low percentages of total alkaloid, and found that in all cases it was feasable to prepare a product having all the physical properties of a good extract and containing 15 per cent. of total alkaloid by the direct evaporation of the strong tincture.[1] The following is a description in official phraseology of the process which we propose for the preparation of a standard extract of nux vomica.

Take of –

Nux vomica, in fine powder	1 pound.
Rectified spirit	64 fluidounces.
Distilled water	16 fluidounces.

Mix the spirit with the water and make the nux vomica into a paste with one pint of the mixture. Allow this to macerate for twelve hours, then transfer to a percolator and add another pint of the mixture. When this has percolated, pour on the remainder of the diluted spirit in successive portions; press the marc, filter the expressed liquid and add it to the percolate. Take of this liquid one fluidounce and estimate the amount of total alkaloid in the following way: Evaporate almost to dryness over a water bath, dissolve the residue in two fluid drachms of chloroform and half a fluid ounce of dilute sulphuric acid, with an equal bulk of water, agitate and warm gently. When the liquids have separated draw off the chloroform and add to the acid liquid excess of solution of ammonia and half a fluidounce of chloro-

[1] Of course such standard extracts prepared from seeds containing different percentages of alkaloid will not have the same consistence; but this variation in consistence is not sufficiently considerable to be of any practical moment.

form, well agitate, gently warm, and after the liquids have completely separated transfer the chloroform to a weighed dish, evaporate over a water-bath and dry for one hour at 212° F. Allow the residue of total alkaloid to cool and then weigh. Take of the percolate as much as contains 131¼ grains of total alkaloid and evaporate over a water-bath until the extract weighs two ounces. This extract will contain 15 per cent of total alkaloid.

Ten grains of this extract when treated in the following manner should yield one and a half grains of total alkaloid. Dissolve the extract in half a fluid ounce of water with the aid of a gentle heat and add a drachm of carbonate of sodium previously dissolved in half a fluidounce of water; add half a fluidounce of chloroform, agitate, warm gently and separate the chloroform. Add to this half a fluidounce of dilute sulphuric acid with an equal bulk of water, again agitate, warm and separate the acid liquid from the chloroform. To this acid liquid add now an excess of ammonia and agitate with half a fluidounce of chloroform; when the liquids have separated transfer the chloroform to a weighed dish and evaporate the chloroform over a water-bath. Dry the residue for one hour and weigh.—*Pharm. Jour. Trans.*, February 9, 1884.

THE PREPARATION OF A STANDARD TINCTURE OF NUX VOMICA.[1]

By Wyndham R. Dunstan,

Assistant Lecturer in Chemistry and Physics to the Pharmaceutical Society and Demonstrator of Practical Chemistry in the School of Pharmacy; and

F. W. Short,

Assistant Demonstrator of Practical Chemistry in the School of Pharmacy.

In the previous paper we have proposed a process for the preparation of a standard extract of nux vomica, containing 15 per cent. of total alkaloid. In considering a feasible method for preparing a standard tincture of nux vomica, we were led by our former results to two suggestions. First, the dilution with alcohol of the assayed percolate (the method of producing which has been described in the former paper) to a definite degree, corresponding to a given percentage of total alkaloid, and second, the solution of a definite quantity of the standard extract

[1] Read at an Evening Meeting of the Pharmaceutical Society, Feb. 6, 1884.

in a given volume of alcohol. We propose that the standard tincture of nux vomica shall contain 0·24 per cent. of total alkaloid, that is 1 grain of total alkaloid in 1 fluid ounce of tincture. This proposal results from a comparison of the analyses which we have already published of the various tinctures of nux vomica now being used in medicine, and represents the alkaloidal content of a good commercial specimen. The mode of preparing the standard tincture by the first method is simple in procedure and eminently satisfactory in result. An experiment was made by taking that volume of the strong percolate, assayed as before described, which contained 20 grains of total alkaloid, this was diluted to one pint with alcohol (100 : 25). A pale yellow perfectly clear tincture was obtained, every ounce of which contained 1 grain of total alkaloid. This tincture did not deposit or otherwise change after being kept for one month. A practical objection perhaps attaches to this method, as one for general use, which must be allowed to have some weight. It involves the preparation of two tinctures of nux vomica, the one strong, the other weak, and the substitution of the one for the other in dispensing would be attended with grave results; this perhaps is an objection to recommending the process for general use, although it is a point on which we speak with some reserve. A number of experiments were then made in connection with the second method. It has been already shown that with ordinary extract of nux vomica there is no very easy method of obtaining a solution in alcohol which is at once perfect and permanent (*Pharm. Jour.* [3], xiv., 442). But it now seemed probable, having prepared an extract by exhausting the nux vomica with alcohol of definite strength and evaporating on a water-bath, that such an extract would redissolve in alcohol of the same strength that had been used in its production. One gram of the standard extract of nux vomica, containing 15 per cent. of total alkaloid, was mixed with 60 cubic centimetres of alcohol (100 : 25). By stirring the whole of the extract was dissolved, and the perfectly clear tincture deposited a very small quantity of a white sediment after one month.[1] Some of the sediment was examined and contained no alkaloid. Thus a standard tincture of nux vomica could also be readily prepared by the solution of the standard extract in alcohol of certain strength. The tincture prepared as above detailed should contain 0·24 per cent. of total alkaloid and to confirm this the tincture was assayed and yielded 0·2402 per cent. of

[1] The extract, it should be noted, will not wholly dissolve in rectified spirit

total alkaloid, thus coinciding with the calculated result. The standard tinctures prepared by the two processes which have been described contain, of course, the same percentage of total alkaloid. They differ in color, that prepared by the first process being pale yellow, by the second, light brown; the latter also deposits very slightly, while the former is perfectly stable. For reasons already stated, we incline to recommending the latter process for general use; the former would probably be preferred by the manufacturer upon the large scale. The following is a description of both the processes which we have devised for the preparation of a standard tincture of nux vomica containing 0·24 per cent. of total alkaloid:

I. Take of—

Nux vomica, in fine powder	1 pound.
Rectified spirit	64 fluidounces.
Distilled water	16 fluidounces.

Mix the spirit with the water and make the nux vomica into a paste with one pint of the mixture. Allow this to macerate for twelve hours, then transfer to a percolator and add another pint of the mixture. When this has percolated, pour on the remainder of the diluted spirit in successive portions; press the marc, filter the expressed liquid and add it to the percolate. Take of this liquid 1 fluid ounce and estimate the amount of total alkaloid in the following way: Evaporate almost to dryness over a water-bath, dissolve the residue in 2 fluid drachms of chloroform and half a fluidounce of dilute sulphuric acid with an equal bulk of water; agitate and warm gently. When the liquids have separated draw off the chloroform and add to the acid liquid excess of solution of ammonia and half a fluidounce of chloroform; well agitate, gently warm and after the liquids have completely separated transfer the chloroform to a weighed dish. Evaporate over a water-bath, and dry for one hour at 212° F. Allow the residue of total alkaloid to cool and then weigh.

Take that quantity of the percolate which contains 20 grains of alkaloid and dilute to one pint (imperial) with a mixture of 4 parts by volume of rectified spirit with 1 part by volume of distilled water. This tincture will contain 0·24 per cent. by volume of total alkaloid and 2 fluidounces of it when estimated, in the same manner as the percolate, should yield 2 grains of total alkaloid.

II. Take of—

Standard extract of nux vomica	133 grains.
Rectified spirit	16 fluidounces.
Distilled water	4 fluidounces.

Mix the spirit with the water and dissolve the extract in the mixture. One fluidounce of this tincture will contain one grain of total alkaloid.

In concluding this the last part of the report, we wish to gratefully acknowledge the valuable assistance which we have from time to time received from Professor Redwood, who has closely followed the progress of the investigation, and made many fruitful suggestions which have contributed to its successful result. We also wish again to thank Professor Attfield for having allowed the work to be carried on in the Laboratories of the Pharmaceutical Society. The investigation has been largely aided by a grant from the Research Fund of the British Pharmaceutical Conference.—*Pharm. Jour. Trans.*, February 9, 1884.

A NEW REACTION AND TEST FOR ATROPINE AND THE MYDRIATIC ALKALOIDS.[1]

By A. W. Gerrard, F.C.S.,
Teacher of Pharmacy to University College.

Whilst studying the behavior of atropine towards mercuric chloride I was somewhat surprised to find on mixing hot alcoholic solutions that they gave a yellow precipitate, which on boiling became red. On diluting the mixture with water a further amount of yellow precipitate was obtained, which also changed to red on boiling.

The precipitate separated, washed and dried, was found on analysis to be mercuric oxide, with a small trace of mercurous oxide.

The reaction representing the first change can be shown by the following equation:

$$2C_{17}H_{23}NO_3 + H_2O + HgCl_2 = 2C_{17}H_{23}NO_3HCl + HgO.$$

In addition to the above reaction, I find that a second one takes place simultaneously. This second reaction is between the atropine hydrochlorate and two more molecules of the mercuric salt yielding the following combination:

$$\underset{\text{Atropine hydrochlorate.}}{C_{17}H_{23}NO_3HCl} + \underset{\text{Mercuric chloride.}}{2HgCl_2} = \underset{\substack{\text{Dimercuric chloride atropine}\\ \text{hydrochlorate.}}}{C_{17}H_{23}NO_3HCl(HgCl_2)_2}$$

On cooling and setting aside a few hours this compound separated in tufts of crystalline plates.

[1] Read at an Evening Meeting of the Pharmaceutical Society, March 5, 1884.

It is seen in the first equation that water is essential to the production of the mercuric oxide, this I have proved by mixing absolute alcoholic solutions, also ethereal solutions of the two salts, but no reaction took place until water was added. As commercial alcohol contains traces of water a slight reaction may follow its use. The above experiment was repeated on hyoscyamine, daturine, duboisine, and homatropine, with the same result, thus affording additional proof of the unity of the mydriatic alkaloids.

The composition of the above double salt was established as follows: 500 milligrammes of the carefully dried salt were dissolved in water, and potassic hydrate added in slight excess; the resulting precipitated mercuric oxide was separated, dried and weighed, then calculated as Hg; it gave 228 milligrammes or 45·6 per cent. The filtered solution and washings from the mercuric oxide were faintly acidified with acetic acid, and the chlorine estimated with argentic nitrate, using potassic chromate as indicator; I thus obtained 99·4 Cl or 19·9 per cent. The difference of the above quantities being assumed as atropine would leave 34·5 per cent. for that body, so that analysis and formula percentages may be thus compared:

	Percentages. Theory.	Percentages. Found.
Mercury	46·1	45·6
Chlorine	20·4	19·9
Atropine	33·3	34·5

To further prove these results another analysis was made as follows: 500 milligrammes of the salt were dissolved in water, and treated with H_2S in excess, and the precipitated mercuric sulphide washed, dried and weighed gave mercury equalling 45·9 per cent. The filtrate and washings were warmed for some time until quite free from H_2S; it was then made neutral with potassic hydrate and the chlorine estimated as above. I now obtained 20·7 per cent. Cl. This result thus confirms the previous analysis.

In addition to the foregoing, I have prepared hydrochlorate of atropine, and treated it with two molecules of $HgCl_2$, and thus obtained the same double compound.

Expecting to find other alkaloids to react in a similar manner, the same test was applied to as many alkaloids as were at my disposal; in no case did I obtain a red precipitate. The following were examined:—Strychnia, brucia, morphia, codeia, veratria, aconitia, conia, gelseminia, caffeia, theia, cinchonia, cinchonidia, quinia and quinidia. With most

of these I obtained white precipitates; the codeia and morphia became pale yellow on boiling; in many cases crystals of apparently new combinations separated.

For practically working the test, I recommend the following procedure: To a small portion of atropine in a test tube, add about 2 cc. of a 5 per cent. solution of mercuric chloride in 50 per cent. alcohol and warm gently; the precipitate will at once appear, and become brick-red in color. Like most alkaloidal reactions, I find there are certain limiting conditions necessary for the success of the test. It does not answer in dilute solutions, neither does it turn out well if the atropine be added to the mercury, but working as I have described the reaction is strongly marked.

In forensic analysis the above test will be of value, as hitherto no reliable chemical test for atropine has been known. This communication also shows, that under certain conditions, atropine, contrary to the general statement, behaves towards mercuric chloride not like ammonia, but similar to the hydrates of the alkali metals.—*Pharm. Jour. and Trans.*, March 8, 1884, p. 718.

LASERPITIN.

By R. Külz.

The author has made an investigation to determine the nature of the bitter principle *laserpitin*, which is contained in the root of *Laserpitium latifolium*, or white gentian root, and to discover the connection (if any) which obtains between this substance and the bitter principles contained in other umbelliferous plants.

Laserpitin.—The finely sliced root was extracted by boiling with light petroleum, and on evaporating the solution *laserpitin* was deposited in crystals belonging to the monoclinic system. These were purified by recrystallization from light petroleum, and were found to contain no water of crystallization. *Laserpitin* melts at 118°, is insoluble in dilute acids or alkalis, but is easily soluble in chloroform, ether, benzene and carbon bisulphide. Concentrated acids decompose it, sulphuric acid dissolving it with the production of a deep red color. This same color is observed when *laserpitin* is boiled with concentrated hydrochloric acid, or with alcoholic potash.

A series of combustions of the pure laserpitin gave numbers point-

ing to the formula $C_{15}H_{22}O_4$. No chloride or bromide of laserpitin could be obtained, but an acetate, $C_{15}H_{22}O_4,\overline{Ac}OH$, crystallized in silky needles from a solution in acetic acid; even this salt was unstable. Several derivatives of laserpitin were obtained. An attempt to produce an acetyl derivative by the direct action of acetic chloride or acetic anhydride gave negative results.

When laserpitin is distilled with zinc dust or soda-lime, no benzene or other aromatic hydrocarbon is obtained, from which the author concludes that the molecule of laserpitin contains no compound constituted on the type of the closed carbon-ring.

The action of concentrated hydrochloric acid on an alcoholic solution of laserpitin gives rise to methylcrotonic acid, and the action of concentrated sulphuric acid yields angelic acid.[1] When laserpitin is heated with dilute nitric acid, oxalic acid is one of the products. Ebullition with alcoholic potash yields angelic acid, and fusion with potassium hydroxide, methylcrotonic acid.

Monacetyllaserpitin, $C_{15}H_{21}\overline{Ac}O_4$, may be obtained by the action of acetic anhydride on laserpitin in presence of anhydrous sodium acetate. It crystallizes in colorless needles, melting at 113°, and soluble in glacial acetic acid, alcohol, ether and chloroform, but insoluble in water.

Dinitrolaserpitin, $C_{15}H_{20}(NO_2)_2O_4,H_2O$, is obtained as an amorphous mass by the action of nitric acid on *laserpitin*. It melts at 115°, and is insoluble in water, but soluble in alcohol, ether, chloroform and glacial acetic acid.

Bromolaserpitin, $C_{30}H_{39}Br_5O_8$, obtained by the action of bromine on a solution of laserpitin in chloroform, crystallizes in rosettes, which are soluble in ether, alcohol, chloroform and glacial acetic acid; they melt at 90°.

Lazerin, $C_{20}H_{30}O_5$, is a resinous substance (called by the author *lazerol*) which is produced when concentrated acids or alkalis act on laserpitin. It is insoluble in acids, but is dissolved by ether, alcohol, chloroform and glacial acetic acid. Its production, together with angelic acid, or methylcrotonic acid, by the action of sulphuric or hydrochloric acids on laserpitin, is symbolized by the equation

[1] In another place the author mentions the production of angelic acid by the action of hydrochloric acid, and of methylcrotonic acid by the action of sulphuric acid on laserpitin, but from internal evidence this is probably a mis-statement.

$$2C_{15}H_{22}O_4 + H_2O = C_{20}H_{30}O_5 + 2C_5H_8O_2.$$

Attempts to produce derivatives of this body were unsuccessful. From these results the author infers that laserpitin is chemically different from peucedanin, ostruthin and athamantin, bitter principles which have been found in other umbelliferous plants.—*Jour. Chem. Soc.*, 1884.

THE CHEMICAL COMPOSITION AND PROPERTIES OF A CRYSTALLINE PRINCIPLE OBTAINED FROM JAMBOSA ROOT.[1]

By A. W. Gerrard, F.C.S.,
Teacher of Pharmacy to University College.

The roots from which the principle under notice was extracted were handed to me in the summer of 1883 by Dr. Murrell, who received them from Messrs. Parke, Davis & Co., with the following information:

"The plant yielding these roots is probably the *Myrtus Jambosa*, L. (*Jambosa vulgaris*, DC.), cultivated on St. Maurice. The fruit has the circumference of a medium sized pear, a smell reminding of roses." In the same communication the plant is also mentioned as the "*Myrtus Jambosa Malacensis*, Spr. Is at home in India and Otaheiti. The fruit is known as the rose apple, is frequently eaten, and the decoction of the bark used as an astringent in dysentery, gonorrhœa and leucorrhœa."

Since I received the root it has been figured in the *Therapeutic Gazette*, and examined and reported on by Dr. A. B. Lyons, who throws some doubt on a statement that it is the root of *Eugenia Jambosa*, and gives his opinion that the root and stem in general aspects resemble plants of the order *Piperaceæ*. Dr. Lyons also names his drug "Jambu assu," stating that it is indigenous to Brazil; but that name is applied in Chernoviz's "Medical Formulary of Brazil" to *Spilanthes oleracea*, the plants of which genus are mostly smooth annual branching weeds, and would scarcely produce roots 10 to 15 millimetres in diameter, the size of jambosa roots. It may turn out that the name "jambosa" is a generic one, used in the Brazils for drugs of the same character; hence its application to both the plants mentioned. I have been enabled, through the kindness of Mr. E. M. Holmes, to examine

1 Read at an Evening Meeting of the Pharmaceutical Society, March 5, 1884.

some flowers of *Spilanthes oleracea;* they yielded me an oleoresin with properties similar to one obtained from jambosa, both being powerful sialagogues.

Dr. Lyons's examination of the root demonstrated that it contained a neutral crystalline principle, an alkaloid, a peculiar acid, and an oleoresin. An independent examination of my own gave similar results, except that I did not notice the alkaloid. I since find it is present, but the quantity is so minute that its study is not worth following.

The extraction of the crystalline principle, which is found only in the bark of the root, is extremely easy. My process was as follows: The bark was separated from the root, finely powdered and percolated with ether; the ether on evaporation gave an adundant crop of crystals, which by washing with ether and again crystallizing from ether were obtained perfectly white.

Properties of Crystals.—They are white and tasteless, melting at 77° C., becoming solid at 60° C.; soluble in cold ether, alcohol, and chloroform, and in hot petroleum ether. They are insoluble in cold water, but soluble on boiling, separating in crystals on cooling. With strong sulphuric acid they yield a bright green color, soon passing to a deep reddish-brown. With strong nitric acid they react violently, giving off nitrous fumes and forming an orange colored liquid, from which water precipitates a new compound. They gave none of the reactions of a glucoside, neither do they possess the character of weak resin acids.

Analysis.—Before combustion the crystals were submitted to fractional crystallization from various fluids; the various fractions proving of uniform composition the product was assumed to be pure. By exposure to dehydrating agents it scarcely lost weight.

Four combustions for carbon and hydrogen were made, giving as the average 60·585 per cent. C, and 7·584 per cent. H. Nitrogen being present it was twice estimated by the absolute method, and after the various corrections gave 7·2 per cent. N, leaving a difference of 24·631 O. These figures allow the construction of the formula $C_{10}H_{15}NO_3$, the theoretical percentages of which I have placed for comparison with those found—

	Analysis.	Theory.
C	60·585	60·91
H	7·584	7·6
N	7·2	7·1
O	24·631	24·39
	100·000	100·00

The name I propose for this substance is jambosin. Therapeutically it is of very little interest, as I have taken several doses without any apparent effect. The active principle of jambosa is no doubt to be found in the oleoresin, which is a powerful sialagogue, and deserving of further research.—*Pharm. Jour. and Trans.*, March, 1884.

DETECTION AND ESTIMATION OF TRINITROPHENOL (PICRIC ACID).

By G. Christel.

This paper contains an examination of the principal reactions of trinitrophenol made with a view to its qualitative detection and quantitative estimation. The aqueous solution of picric acid is not precipitated by neutral solutions of lead or copper salts; neither is ammonium picrate, unless the solution is alkaline, when lead acetate gives a reddish yellow precipitate and copper sulphate a yellowish green precipitate in dilute solutions, and a bright green in concentrated solutions. A solution containing half a milligram of picric acid in 5 cc. of water is not at once precipitated by a solution of cuprammonium sulphate, but on standing for 24 hours a distinct precipitate is obtained, which is insoluble in ammonia, but is decomposed by water. Solution of basic lead acetate is a very delicate test for picric acid, yielding a bright yellow precipitate. A solution containing the tenth of a milligram of picric acid in 5 cc. of water, gives after 12 hours a distinct precipitate, and a solution containing the twentieth of a milligram in 5 cc. of water a strong opalescence, which subsequently forms a distinct sediment. When this sediment is decomposed by the addition of 1 drop of sulphuric acid, and the solution is rendered alkaline with ammonium hydrate and evaporated to dryness, a residue is left which, when dissolved in a little water and warmed with a drop of potassium cyanide solution, gives a distinct red color. The yellow coloring matters of the bark of *Quercus tinctoria* (quercitron), and the root of *Broussonetia tinctoria* also give precipitates with basic and neutral lead acetate, but the precipitates do not give the reaction with potassium cyanide when treated as above described. An aqueous solution of methyl green precipitates solutions of picric acid. The green precipitate dissolves in ammonia, forming a deep yellow solution, which is precipitated by basic lead acetate, and this precipitate gives the reaction with potassium

cyanide. This test cannot be applied for the detection of picric acid in beer, for 1 litre of beer which contained 5 milligrams of picric acid was not precipitated by a solution of methyl green. Solutions of picric acid are precipitated by stannous chloride, and if a small quantity of ammonia is added, the solution becomes red. The same reaction is obtained when a solution, prepared by adding potassium hydroxide to a solution of stannous chloride until the precipitate at first formed is redissolved, is added to a solution of picric acid. The red color is due to the formation of dinitroamidophenol (picramic acid): hydrogen and ammonium sulphides give a similar reaction. If a solution of picric acid or a picrate is acted on with zinc and dilute sulphuric acid, a yellowish red turbid solution is obtained, which, when poured off and mixed with alcohol, develops a green color, changing through blue to a violet-green. For the detection of picric acid in sweetmeats or other colored substances containing sugar, the potassium cyanide reaction can be applied directly; or the coloring matter may be extracted with alcohol, the residue from this solution, after dissolving in water, precipitated by lead acetate; and the potassium cyanide reaction obtained after decomposing the precipitate in the manner above described. For the detection of picric acid in wool or cellulose, the hydrochloric acid solution may be reduced by zinc, and the reaction with alcohol obtained. The substance may also be digested with ammonia, and the potassium cyanide reaction tried with this solution. The detection of picric acid in beer cannot be accomplished by means of lead acetate, on account of the other substances in the liquid, which are precipitated by this reagent; neither can the coloring matter be removed by animal charcoal, for this also retains the picric acid. For the detection of picric acid in beer, the author recommends the following method: 200 cc. of the beer are evaporated to a syrupy consistence on the water-bath, and then digested in a flask with 50 cc. of alcohol (99 per cent.), the mixture being allowed to stand for 24 hours, when it is filtered, and the residue washed with 31 cc. more alcohol. The mixed filtrates are evaporated to the consistence of a syrup and acidified with two or three drops of dilute sulphuric acid. The mixture is then extracted with five or six times its volume of ether, the latter removed, the solution again acidulated and extracted with ether. The ethereal solutions are spontaneously evaporated, and the residue dissolved in 5 or 10 cc. of water, the solution filtered, neutralized with ammonia, and tested by one of the methods above described. For the estimation of picric acid,

the author proposes a colorimetric method, based on the potassium cyanide reaction. The ethereal residue is diluted to 10 cc. with a little ammonia, 5 or ten drops of a 10 per cent. potassium cyanide solution added, and the liquid, after heating it to 80°, is diluted to 100 cc. with dilute ammonia. The color produced is compared with that given by a certain quantity of a standard solution of picric acid, 100 cc. of which contain 0·1 gram of pure picric acid, the operation being conducted in the same way.—*Jour. Chem. Soc.*, Feb., 1884; *Arch. Phar.*, (3) xxi, 190.

NOTE ON LOGWOOD AS A TEST FOR METALS.[1]

By Arthur Weddell.

For some years past I have been accustomed to examine potable waters for metallic impurities by means of the alteration produced in the coloring matter of logwood, and as it furnishes a delicate and convenient means of detecting their presence I have thought it worth bringing before this Society. When logwood is digested with alcohol an extract of a rich yellow color results, and this color is not changed on dilution with a pure, freshly distilled water. When added to ordinary samples of water, which contain calcium carbonate in solution, the yellow color is changed to a beautiful rose red, or if a metal be present to blue.

These changes are accounted for in the following manner: Hæmatoxylin, the ordinary coloring matter of logwood, is converted by oxygen, especially in the presence of alkalies, into an oxidized product known as hæmatëin, which gives a blue precipitate with salts of iron, lead, copper and many other metals, or if the solution be extremely dilute, a blue coloration only. This reaction is so delicate that 1 part of lead in 100,000 parts of water is easily detected, and with care 1 part in 200,000.

These changes do not occur in acid solutions. The method of using the test is extremely simple and consists in the addition of a few drops of a very dilute tincture of logwood to the sample under examination, care being taken that the quantity added is not too great, as a trace of metal may be thus overlooked, owing to the difficulty of observing the change of color in presence of a large excess of red coloring matter.

My own practice is to prepare an alcohol extract of logwood (strength

[1] Read at an Evening Meeting of the Pharmaceutical Society, March 5, 1884.

1 in 100) by maceration and to note how much of this is required to produce a distinct rose color in 100 cc. of distilled water rendered faintly alkaline with ammonium carbonate, or in 100 cc. of hard water free from metals.

This quantity of logwood solution is next added to 100 cc. of the water under examination, and the two tubes compared. If a rose color is developed, metals are absent, while a blue color indicates their presence.

More logwood may afterwards be added to each tube and the progressive differences noted, the blue color increasing in depth, or to a precipitate if much lead be present.

By adding sufficient lead solution of known strength to the pure water, so as to imitate the color in the second tube, as in Nesslerizing, an approximate idea of the amount of lead may be obtained, when it is known that no other metal is present; but I have not considered the reaction worth experiment in this direction, because the exact comparison is somewhat difficult and can hardly reach scientific accuracy.

The presence of free acids interferes with the reaction, and these, if present, must therefore be carefully neutralized and a slight excess of alkali added. Free carbonic acid gas should be removed by boiling, but I have never met with drinking water that required such treatment.

A variety of applications of this test will suggest themselves. Some years ago I recommended a convenient means of testing glycerin for lead and other metals, by adding the glycerin to water colored red with logwood. Soda water may be examined by boiling to free from CO_2 and adding the logwood. Lemonade by adding a slight excess of pure alkaline carbonate and boiling. The mineral and vegetable acids may be examined by neutralizing carefully and adding the solution to water colored red with logwood.

My attention was first attracted to this test by observing that distilled water stored in a metal cistern when used to dilute a logwood tincture turned it to a dirty greenish color, and when this was mixed with tap water it turned blue. On examining the distilled water by the ordinary method, with SH_2, the presence of lead was detected, it having been dissolved from the solder used in the joints and in fixing the tap. As I have since met with this same condition of storage and impurity I think it would be well for those who store distilled water in such a manner to ascertain the absence of lead before using it.—*Pharm. Jour. and Trans.*, March 8, 1884, p. 717.

ON THE PREPARATION OF PURE CHLOROPHYLL.

By Dr. A. Tschirch.

All attempts hitherto made to prepare pure chlorophyll must be regarded as failures, their authors having started with the idea that chlorophyll is a comparatively stable substance, not altered by treatment with hydrochloric acid, etc. But an exact study of the alterations produced in the very characteristic spectrum of living leaves and of alcoholic chlorophyll solutions, by the action of various reagents, shows that pure chlorophyll is an extremely unstable body, which is decomposed even on treating the leaves with alcohol, even though no alteration of color is thereby produced. Hence it follows that the substances hitherto described as "chlorophyll" or "crystallized chlorophyll," and obtained either by treating chlorophyll extracts with strong hydrochloric acid, and precipitating the resulting blue solution (phyllocyanin) with excess of water[1] or with marble[2]—*i. e.*, by energetic chemical actions—or by absorbing the chlorophyll from its alcoholic solution with animal charcoal and washing it out with ether[3]—must be regarded as products of decomposition more or less remote from the original substance.

This conclusion is confirmed by spectroscopic examination, which shows that the crystallized chlorophyll of Gautier and Rogalski is identical with the chlorophyllan of Hoppe-Seyler ("Zeitschr. Physiol. Chem.," [3], 347), which, as I have shown ("Ber. der deutsch. botan. Gesellsch., [1], 145), is a product of the oxidation of chlorophyll, and that the pure chlorophyll of Berzelius, Mulder and Pfaundler is identical with Frémy's phyllocyanic acid.[4] Here, then, are two bodies which agree perfectly in their absorption spectra, but—as shown by their behavior to caustic alkalis, which dissolve phyllocyanic acid,

[1] Berzelius ("Annalen," [27], 298).—Harting ("Pogg. Ann.," [96], 547).—Pfaundler ("Annalen," [115], 43).

[2] Mulder ("J. pr. Chem.," [33], 479).

[3] Gautier ("Comt. rend.," [89]' 862).—Rogalski ("Compt. rend.," [90], 881), and Rôle de la chlorophylle dans l'assimilation.—"Inauguraldissertation," Krakau.

[4] ("Compt. rend.," [61], 191.)—I here designated as *Phyllocyanic acid* only the body formed by decomposition of phyllocyanin, which is not identical with that which Frémy obtained by treating chlorophyll with barium hydroxide, magnesia or alumina, and decomposing the resulting salts with acids.

but not chlorophyllan—are nevertheless totally distinct one from the other.[1]

But it is not only towards concentrated acids that chlorophyll is so sensitive, for it is quickly decomposed even by weak acids,[2] always with formation of chlorophyllan. The constant presence of vegetable acids in the cells of the leaf explains, therefore, the rapid decomposition of chlorophyll tinctures, which, as may be shown spectroscopically, takes place even during the preparation of the solution, and goes on till the whole of the chlorophyll is converted into chlorophyllan, as evidenced by the change of color of the liquid from green to yellow. Hence all attempts to obtain the coloring matter in the pure state from chlorophyll solutions, either by precipitation with saline solutions, as I formerly proposed (*loc. cit.*, p. 181), or by separation with benzene, carbon sulphide, etc., fail in their object, inasmuch as the coloring matter is decomposed by the accompanying substances, even during the process of extracting it from the leaves.

Equally unavailing have been the attempts made to prepare the pure coloring matter by saponification of chlorophyll extracts. Chautard, ("Compt. rend.," [76], 570) has drawn attention to the differences between the spectroscopic characters of these alkaline solutions of chlorophyll and those of chlorophyll tincture. I myself have also further studied the action of alkalis, and have found that this treatment always yields products of decomposition, recognizable as such by their spectroscopic characters.

According to the present state of our knowledge, we must regard as pure chlorophyll the product whose absorption spectrum agrees with that of living leaves, as regards both the positions of the individual bands and likewise their breadth and intensity. Such a body I have obtained by a reduction of chlorophyllan, a substance easily obtained in the crystalline state by the action of zinc dust on alcoholic solution of chlorophyllan at the heat of the water-bath.

[The author then describes the absorption spectra of this emerald-green body and of living leaves, and continues:]

[1] The spectroscopic behavior of these two bodies shows, therefore, that a body may undergo chemical alterations not recognizable by spectroscopic observation.

[2] Compare also Kraus, "Zur Kenntniss der Chlorophyllfarbstoffe und ihrer Verwandten."—Stuttgart, 1872. Sachsse, "Die Farbstoffe, Kohlehydrate und Proteinsubstanzen.—Leipzig, 1877.

Pure chlorophyll prepared as above forms blackish-green drops, which have not yet been made to crystallize. It dissolves with great facility in alcohol, ether and benzene, easily also in oils both fatty and volatile, sparingly in fused paraffin, not at all in water. It is converted by dilute acids into yellow chlorophyllan, by strong hydrochloric acid into blue phyllocyanin, and is resolved by potash lye into an emerald-green substance which dissolves readily in water, forming an emerald-green strongly fluorescing liquid, externally very much like chlorophyll solutions, and a yellow body which may be extracted by ether from the aqueous solution. The alcoholic solution of pure chlorophyll is much less sensitive to light than ordinary tincture of chlorophyll. I regard this pure chlorophyll as identical with the chlorophyll of living plants, and reserve to myself the right of examining it further.

The following is a contribution to the synonymy of certain bodies of the chlorophyll group:

Chlorophyll (Pelletier and Handbooks) = crude chlorophyll (Wiesner).—Cyanophyll + Xanthophyll (G. Kraus).

Cyanophyll (G. Kraus) = chlorophyll (Wiesner).—Blue chlorophyll (Sorby).—Pure chlorophyll (Tschirch) + some *a*-Xanthophyll.

Chlorophyllan (Hoppe-Seyler) = Modified chlorophyll (Stokes).—Acid chlorophyll of the Handbooks.—Acidoxanthin (C. Kraus).—Filhol's precipitate (obtained on adding organic acids to chlorophyll tincture).—Crystallized chlorophyll (Gautier and Rogalski).—Pure chlorophyll (Jaudin).—Yellow chlorophyll (Sorby).—*a*-Hypochlorin (Pringsheim's hypochlorin).—(?) Borodin's chlorophyll crystals.—Coloring matter which produces the winter fading of certain evergreen plants (Haberlandt, G. Kraus, Askenasy).—Coloring matter which produces the discoloration of strongly acid leaves in the dark.

Phylloxanthin (Frémy?) (Tschirch) = xanthophyll (Berzelius) ex part.—? Chlorophyllic acid (Liebermann).—Xanthin (C. Kraus).

Phylloxantheïn (Weiss) = alkali phyllocyanate (Tschirch).—Frémy's etiolin.

Phyllocyanic acid (Frémy, ex part) = pure chlorophyll (Berzelius, Mulder, Pfaundler, Harting).

Body precipitated by water from solution of phyllocyanin (Tschirch).—(?) Chlorophyllanic acid (Hoppe-Seyler).

Potassium chlorophyllinate (Tschirch) = Chlorinkali (C. Kraus).—Sachsse's precipitate formed by potassium or sodium in solution of cyanophyll.

***a*-Xanthophyll**[1] = xanthophyll (G. Kraus).

[1] The xanthophylls here enumerated are perhaps identical; but till the point is definitely established, they may be conveniently distinguished by Greek letters.

β-Xanthophyll = xanthophyll (Pringsheim). Yellow coloring matter of autumn leaves (perhaps identical with α).

γ-Xanthophyll = yellow coloring matter soluble in ether; precipitated by potash from cyanophyll.—Xanthin (Dippel).—Xanthin (G. Kraus, ex part.

δ-Xanthophyll = Frémy's phylloxanthin, separated by barium hydroxide from cyanophyll.

ε-Xanthophyll = yellow coloring matter formed in Sachsse's reaction (treatment of cyanophyll solution with sodium); permanent in benzene solution (perhaps identical with γ).

Xanthophyll (G. Kraus) = etiolin (G. Kraus).—Xanthophyll (Sorby) ex part.

Erythrophyll (Bougarel?) = chrysophyll (Hartsen).—Borodin's yellow crystals.—ι-Xanthophyll (Tschirch).

Anthoxanthin (Marquardt) = anthoxanthin (Pringsheim).—Xanthin and Xantheïn (Frémy and Cloëz).

Yellow coloring matters of flowers.—*Jour. Chem. Soc.*, 1884, p. 57–62.

ON THE CONSTITUTION OF CHLOROPHYLL.

By Edward Schunck, F.R.S.

A Paper read before the Royal Society, December 20, 1883.

An examination of some products derived from chlorophyll, which has occupied me for some time, has led to the question of the true nature and constitution of chlorophyll, a question on which widely different opinions prevail. Without entering into matters which concern the physiologist only, it may be said that to the chemist chlorophyll is simply an organic coloring-matter, the substance to which the green color of leaves and other parts of plants is due. Now coloring-matters are of three kinds. To the first class belong such as occur ready formed and in a free state in vegetable and animal organisms, such as the coloring-matters of turmeric and safflower. The second class comprises those that are formed from colorless chromogens by the combined action of alkalies and oxygen, the coloring-matters of logwood and archil being well-known examples of this class. These coloring-matters change rapidly when exposed to the further action of oxygen in the presence of alkali, but are quite stable when in contact with acids. The third class consists of glucosides, bodies which do not undergo any considerable change under the influence of alkalies, but are rapidly decomposed when acted on by acids or ferments, yielding, on the one hand, some kind of glucose, and, on the other, sub-

stances in which the tinctorial properties of the parent substance are much more pronounced. To this division belong the coloring-matters of madder, quercitron, cochineal, etc. Now chlorophyll in its general properties so much resembles the members of the last class that one cannot help suspecting that to this class it may belong—that it is, in fact, a glucoside. It shows considerable stability in the presence of alkalies, but acids decompose it rapidly, giving rise to substances which are intensely colored and show a power of absorbing particular parts of the spectrum much more strongly than chlorophyll itself. Whether along with the latter bodies, it yields by decomposition with acids some kind of glucose seemed to me a question worthy of attention.

If it was possible to obtain chlorophyll in a state of purity it would be very easy to settle this question; unfortunately all attempts hitherto made to separate and purify chlorophyll have ended in its decomposition. I consider it as certain that the so-called crystallized chlorophyll which has been described by several authors is in fact a derivative of chlorophyll formed during the process employed for preparing it. It is, however, very easy to obtain a solution of chlorophyll which shall be quite free from everything soluble in water extracted at the same time from the plant, and therefore free from ready-formed glucose. In order to effect this I proceed as follows:—Having extracted leaves of any kind with boiling alcohol, I allow the extract to stand for some time, filter off the deposit which usually forms, and then mix it with its own volume of ether and with about two volumes of water, shaking up well. The liquid now separates into two layers, an upper green one, containing all the chlorophyll of the extract, and a lower bright yellow one, which contains tannin, a yellow coloring-matter, a substance giving the glucose reaction with Fehling's solution, and probably other substances besides. The two liquids are separated in the usual way, and the upper one is shaken up with fresh water, which now usually only shows a trace of color. This process of washing may be repeated, adding each time a little fresh ether, until the lower layer ceases to give the glucose reaction. The upper liquid leaves on spontaneous evaporation a bright green residue, which, though far from being pure chlorophyll, is free from everything soluble in water, and may therefore be employed to determine whether anything soluble in water, such as glucose, is formed by the action of acids on it. If some of the residue be treated with concentrated sulphuric acid in the cold it dissolves, forming a green solution, which, after standing for some time, gives, on the addition of water, a dark green precipitate. This precipitate

consists essentially of two substances, the phyllocyanin and phylloxanthin of Frémy, which are undoubtedly products derived from chlorophyll, showing the absorption-bands of what is usually called "acid chlorophyll." The liquid filtered from this precipitate, when mixed with copper sulphate and an excess of caustic alkali, becomes blue, and the mixture, on boiling, deposits cuprous oxide. The experiment may be made in a slightly different manner. The residue left by the green ethereal solution of chlorophyll having been dissolved in alcohol, sulphuric or hydrochloric acid is added to the solution, which is then boiled for some time, evaporated so far as to drive off most of the alcohol, filtered from the products insoluble in water, made alkaline, then mixed with Fehling's solution and boiled, when the usual glucose reaction takes place. In order to make sure that the reaction was not due to ready-formed glucose, I took in every case the precaution of testing a portion of the green chlorophyllic residue with Fehling's solution before acting on the rest with acid. This was easily done by treating with weak alcohol, to which a little alcoholic potash and some Fehling's solution were added, and heating, when the whole dissolved easily, giving a green solution, which, on boiling, in no case deposited the least trace of cuprous oxide, whereas, after adding an excess of hydrochloric acid to the liquid, boiling, filtering off the insoluble products, again making alkaline and boiling, the glucose reaction took place in a marked manner.

This experiment has never in any case failed, and it would follow, if uniformly successful, that the green leaves of all plants contain a glucoside insoluble in water, but soluble in alcohol and ether. That this glucoside is, in fact, chlorophyll seems to me highly probable. Nevertheless, absolute certainty cannot be attained, because the matter experimented on is a mixture, and it is possible that one plant out of many might give a decidedly negative result, which would upset the conclusion drawn from the rest. Assuming, however, that the phenomena will always occur as above described, and that the reaction with Fehling's solution indicates the presence of some kind of glucose, it would follow either that chlorophyll is a glucoside or that it is always accompanied in the vegetable cell by a glucoside of very similar properties. I may add that I attempted to isolate the glucose or glucose-like substance formed under the circumstances described, spinach leaves being the material employed, and obtained a pale yellow gum-like substance which showed no tendency to assume a crystalline form.—*Chem. News*, Jan. 4, 1884, p. 2.

MICROSCOPICAL CHARACTERISTICS OF VEGETABLE FIBRES.

In a paper on this subject in the "Zeitschrift für Warenkunde," Dr. V. Berthold classifies the more important vegetable fibres, according to the action upon them of iodine and sulphuric acid, as follows:

A. Colored blue, violet, or green by iodine and sulphuric acid: Flax, Chinese grass and ramie (*Boehmeria nivea*), roa (*Pipturus argenteus*), cotton, hemp and sunn-hemp (*Crotalaria juncea*).

I. Transverse sections colored blue or violet, but showing no yellow middle lamella; cell-cavity usually filled with a yellow mass.

a. Flax.—Transverse sections occur either isolated or a small number grouped together; the separate transverse sections are not contiguous; they are polygonal, bounded by straight lines, and have sharp edges. Lamination evident, blue or yellow cell-cavity, yellow dot. Longitudinal distortions of the striæ are indicated by darker lines, which usually cross.

b. Chinese Grass and Ramie.—Transverse sections isolated or a small number in a group; their connection very loose; they are polygonal or irregular, and very large. Lamination very evident; cell-cavity large and irregular, often filled with dark yellow masses; sometimes striated radially. The breadth of the fibres is very variable, in the longitudinal aspect some appear very broad; distortions evident; the ends thickly rounded.

c. Roa-fibre.—Transverse sections not many in a group, polyhedral, usually with straight or slightly curved sides and rounded edge; cell-cavity narrowly oblong, regular; contents sometimes yellow. Some transverse sections are surrounded by a thin greenish lamella, and show well-marked radial striæ or fissures, and concentric lamination; the separate lamellæ vary in depth of color.

d. Cotton.—Transverse sections always isolated, rounded, of various forms, usually kidney-shaped; cell-cavity narrow, linear; contents usually yellow. No lamination.

II. Transverse sections blue or violet, polyhedral, rounded or irregular, always surrounded by a yellow middle lamella.

a. Hemp.—Transverse sections always in groups, contiguous, with rounded edge, surrounded by a thin yellow middle lamella, beautifully laminated concentrically; cell-cavity linear, simple or branched, irregular, sometimes broad, without contents.

b. Sunn-hemp.—Transverse sections numerous in a group, closely contiguous, resembling those of hemp, often sickle-shaped, either polyhedral or oval, with a small round cell-cavity; often with yellow contents. Surrounded by a broad yellow middle lamella, from which the inner laminæ are often detached.

B. Colored yellow by iodine and sulphuric acid.

I. Dicotyledons. No vessels besides the bast fibres; cell-cavity with constrictions.

1. Transverse sections in groups, polygonal, bounded by straight lines, with sharp edges; cell-cavity round or oval, smooth, empty; surrounded by a narrow middle lamella of the same color.

a. Jute.—Cell-cavity large, roundish, oval; middle lamella very narrow; no lamination; the ends always rounded, and almost always strongly thickened.

b. Abelmoschus.—Transverse sections larger than in *a*, bounded by straight lines, sharp-edged; cell-cavity a dot or line, oval, rarely angular, smaller than in *a*. Fibres of uniform thickness, ends broad, rounded, often thickened; cell-cavity variable, often reduced to a line.

2. Transverse sections always in groups, polygonal, bounded by straight lines, with sharp or slightly rounded edges; cell-cavity empty. Middle lamella broad and decidedly darker than the transverse section; cell-cavity with constrictions, locally entirely absent.

a. Hibiscus.—Edges sharp or rounded; in the first case the cell-cavity small, in the latter case broader and oval; middle lamella sometimes wanting; transverse sections only slightly and inconspicuously laminated. Fibres of very various thickness, not usually striated longitudinally; ends blunt and almost always thickened.

b. Urena sinuata.—Edges sharp; cell-cavity very small, a dot or narrow short line; middle lamella broad and very distinct; transverse section not laminated. Fibres of uniform thickness, rarely striated longitudinally; ends rounded, rarely somewhat thickened.

II. Monocotyledons. Vessels in addition to bast-fibres; cell-cavity without constrictions.

1. Transverse section usually rounded, rarely polyhedral; cell cavity always round; no middle lamella.

a. New Zealand Flax (*Phormium tenax*).—Transverse sections small, usually round, closely contiguous, polygonal, with rounded edges; cell-cavity empty. Fibres thin, uniform, smooth, rigid; cell-cavity small, of uniform breadth, without striation or distortion; ends sharp.

c. Manila Hemp (*Musa textilis*).—Transverse sections polygonal, with rounded edges or roundish; cell-cavity large, roundish, sometimes with yellow contents. Fibres of uniform thickness, smooth, not striated, with thin walls; ends sharp or slightly rounded. After combustion of the fibre siliceous skeletons remain behind in the form of strings.

2. Transverse section evidently polygonal; cell-cavity polygonal, with one or more sharp edges, moderately large; no middle lamella.

a. African Hemp (*Senseviera*).—Transverse sections closely contiguous, not laminated. Fibres thin, smooth, with sharp ends.

b. Aloe.—Transverse sections not very numerous in a group; edges slightly rounded; cell-cavity not very large, polygonal, often with rounded ends; large spiral vessels. Fibres of uniform thickness, without structure; ends sharp or rounded.

c. Agave.—Transverse sections polygonal, bounded by straight lines, closely contiguous; cell-cavity large, polygonal; its edges less sharp. Fibres rigid, considerably broader towards the middle; ends broad, thickened, sometimes split.

3. *Yucca.*—Transverse sections polygonal, closely contiguous, small, bounded by straight lines; edges very sharp; cell-cavity small, round or linear; middle lamella very evident. Fibres narrow, striated, with sharp ends.—*Phar. Jour. and Trans.*, Jan. 26, 1884, p. 587.

MANUFACTURE OF CELLULOSE.

The use of sulphurous anhydride in the manufacture of cellulose is becoming of more importance every day. In 1876 Mitscherlich recommended treating finely divided wood under pressure with a solution of calcium bisulphite obtained by placing calcium carbonate in a tower and introducing water into the top and sulphurous anhydride into the bottom. Paper made from the resulting cellulose was found to be exceedingly tough, and has been sold as a second quality parchment paper, although it does not possess the qualities which characterize this paper. The details of Mitscherlich's process have since been kept secret. Francke works with solutions of calcium, magnesium, or sodium sulphite of 4° to 5° B., at a pressure of 4 to 5 atmospheres, the operation being completed in 12 to 15 hours. He uses rotary horizontal cylindrical boilers lined with lead, the lining being independent of the outer casing, thus forming a separate boiler. The essential theoretical difference between the lime and the magnesia process is that the resulting calcium sulphate, being almost insoluble, remains in the lignose, whilst the magnesium sulphate is removed during the wa-hing operation. At present it is uncertain whether other differences exist between the two processes.

The cost of pulp by Eckmann's method, depending on the use of magnesium sulphite, is 26 marks per 100 kilos., the selling price being about 40 marks. During last summer this method was tested by a number of French paper manufacturers with the following results: The quantity of wood employed was 4,395 kilos., in the form of fir planks. The loss by removal of knots in chopping, grinding, etc., amounted to 825 kilos. The remaining 3,570 kilos. yielded 1,437 kilos. dry cellulose, corresponding with 32·68 per cent. of the original wood. The latter contained 21 per cent. of moisture, so that the yield on the dry substance is equal to 40 per cent. This is considerably less than the yield obtained by the Francke-Mitscherlich process; the quality of the pulp, however, is far superior. According to recent trials made by Eckmann, it is shown that it is possible to obtain at will either isolated cells or fibrous bundles by using either hydrogen magnesium sulphite or magnesium sulphite. In the former case, the coloring and glutinous substances are completely dissolved, whilst in the latter case a portion of the gluten remains in the fibres.

Archbold macerates the woody tissue with dilute milk of lime, saturates with sulphurous anhydride at a pressure of 4 to 5 atmospheres, and washes the mass with water.

Tilghman's method consists in boiling in closed vessels wood, esparto or flax, with sulphurous anhydride or calcium bisulphite, or both.

Pictet recommends the use of liquid sulphurous anhydride. Finely divided wood is first immersed in water, and for every litre 120 grams of liquid sulphurous anhydride is added. At a temperature of 85° a pressure of 7 atmospheres is produced, so that the incrustating substances of the wood are strongly attacked. The pulp has the grey color of the original wood, but may be easily bleached.

In discussing the sulphite treatment, Bourdilliat contradicts the state-

ment that sulphuric acid is formed when wood is boiled with sulphites; moreover, he believes that the sulphurous anhydride dissolves the incrustating substances of the wood, bleaches the coloring matters, and deposits finely divided sulphur in the fibres, whilst the resins, which are attacked by sulphurous anhydride, form soaps with the base of the bisulphite. These, together with the sulphur, remain in the fibre and add considerably to its weight; the loss during the washing operations is therefore not of fibre but of the mass-compound of sulphur, resin and lime.

Cross is under the impression that the action of the magnesium sulphite is to prevent the oxidation of wood and lignified cellulose when heated with water under pressure. For comparing the success of the different sulphite processes, the test for lignose with aniline sulphate is said to give unsatisfactory results: it is preferable to treat the cellulose first with chlorine and then with sodium sulphite; if lignose is present, a magenta color is produced.—*Jour. Chem. Soc.*, Feb., 1884; *Dingl. Polyt. Jour.*, vol. 249.

PHARMACEUTICAL COLLEGES AND ASSOCIATIONS.

PHILADELPHIA COLLEGE OF PHARMACY.—At the close of the *Junior* course an examination was held on Thursday, February 14. The practical examination took place in the forenoon; the written examination, which was held in the afternoon and evening, was on the following questions:

BOTANY AND MATERIA MEDICA.

1. *Leaves.* Describe briefly their anatomical structure (Epidermis, Stomata, Parenchyma, Palisade Layer and Veins).

2. Explain by description or diagram the general character of *Indefinite* or *Centripetal*, and of *Definite* or *Centrifugal Inflorescence*. Show how both forms are combined in the inflorescence of mint.

3. *Seeds.* Give two examples each of seeds with and without albumen. What is the origin of the tissue called albumen (Endosperm and Perisperm)?

4. *Peppermint.* Give the botanical name and habitat of the plant. Describe it (stem, branches, leaves, inflorescence, calyx, corolla, stamens, ovary). How much Volatile Oil does it yield? What is the name of its Stearopten?

5. *Coniferæ.* In what respect does the structure of the wood differ from that of dicotyledons? Name several officinal drugs derived from this natural order.

CHEMISTRY.

1. What is a Thermometer? What two Thermometer Scales are now used in the United States Pharmacopœia? What are the fixed points on each of these, and how is the intervening space divided? How can you convert readings of one of these into the corresponding readings of the other? What are the limits of heat and cold capable of being recorded by the Mercury Thermometer?

2. In what several ways can electricity be developed? Is there any difference in the character of the Electricity developed by the frictional machine and that developed by the galvanic battery. Which would be used for nickel or silver plating, and which has the stronger physiological effect?

3. How is Chlorine made? State the materials used and write the chemical reaction. How do you explain its bleaching action? What compounds

does it form with the metals? Give the chemical formulas of one or more such compounds.

4. What is the difference between a *Sulphide*, a *Sulphite* and a *Sulphate*. Give the chemical formula of one compound of each of these classes. What are the tests by which we distinguish each of these classes.

5. Write the reaction for the manufacture of Nitric Acid, *a*, as carried out commercially, and *b*, as made on a smaller scale. Give the formulas of three Nitrates.

PHARMACY—THEORETICAL AND PRACTICAL.

1. What is the specific gravity of five grammes of Hydrochloric Acid? What is the specific gravity of a pint of the same liquid? What is the weight of a litre of Nitric Acid?

2. Explain the effect of heat upon the principles obtained from organic substances by solution as in tinctures, infusions, decoctions, etc. What relation does the strength of an extract bear to the drug from which it is made? Explain the difference between an inspissated juice and an alcoholic extract.

3. Why was "Vinum Album Fortior" introduced into the United States Pharmacopœia? And how is it made?

4. How many systems are recognized in Crystallography? How may the proper degree of concentration of liquids intended for crystallization be judged? What is Isomorphism?

5. How is Spirit of Ammonia U. S. P. 1880 made? How is its strength indicated in the officinal definition?

COMMITTEE.

1. Briefly describe and illustrate by diagram the structure of a woody Dicotyledonous stem.

2. What are Molecules? How do Molecules differ from Atoms? What difference exists between the Molecular condition of Liquids and Gases? What effect has heat upon the Molecules of matter.

3. Describe a Barometer, and state its principle of action. How do the influences which cause variations in a barometer affect the ordinary boiling point of a liquid?

4. In what form is Phosphorus usually found in commerce? What precaution is necessary for its preservation? Describe briefly its mode of manufacture. Give the names and chemical formulæ of the several varieties of Phosphoric Acid.

5. Explain the uses of plain and plaited Filters respectively. Describe a method of hastening the process of filtration. What is the best angle for the sides of a funnel to make with each other for ordinary pharmaceutical uses?

PRACTICAL EXAMINATION.

1. Percolate 4 oz. av. of Ground Wild Cherry Bark with one pint of water.

2. Dissolve one ounce of commercial chloride of ammonium in water, purify it, retain one-half of the solution, pouring it into the small bottle; leave the funnel containing the filter, in the bottle for examination.

3. Granulate the remainder of the solution and put the product in a pasteboard box.

The specimens for examination and recognition were as follows:

Marrubium,	Tinct. zingiberis,	Aqua chlori,
Chondrus,	Syrupus tolutanus,	Potassii chloras,
Matricaria,	Ferri sulphas præcip,	Magnesii sulphas,
	Unguentum zinci. oxidi.	

The re-examination of those students who failed in one or more branches

will be held on Monday afternoon, September 29, at 3 o'clock, when others also will be examined under the rules of the College prior to entering the senior class.

The *Senior* examination took place from Tuesday, February 26, and closed on the following Saturday with the examinations in practical pharmacy and in chemical analysis. The questions were as follows:

MATERIA MEDICA.

A. Canadian Hemp. Give the botanical name, natural order, habitat and officinal part of the plant. Describe the physical and structural characters of the drug, and state how it differs from the corresponding part of an allied indigenous plant. Give the medical properties and dose of the drug.

B. Bloodroot. Which part is officinal? Give the botanical name, natural order and habitat of the plant. Describe the physical and structural characters of the drug, and give its medical properties and dose. Give the important characters of one of its alkaloids, and name another officinal plant containing the same alkaloid.

C. Logwood. Give the botanical name, natural order and habitat of the tree. Describe the drug and state how it differs from other woods having a similar color. Name and characterize its important constituents. Give its medical properties and dose.

D. Willow-bark. Give the botanical name, natural order and habitat of the tree. Describe the physical and structural characters of the drug, and state its difference from the bark of old wood. Give the outlines of a process for preparing its bitter principle; also, the chemical characteristics of the latter.

E. Senna leaves. From which genus and which natural order are they obtained? How does the tribe "Senna" differ from other tribes of the same genus? Name the commercial varieties, and give of each the botanical name and habitat of the plant, the principal characters of the drug and its admixtures. To which principle are the laxative properties of Senna mainly due, and what is its behavior to solvents?

F. Colocynth. Give the botanical name, natural order and habitat of the plant. Describe the drug, state the cause of the plump or shrivelled appearance of the commercial varieties and explain the growth of the placentæ. What is the percentage of seeds and pulp? Give the medical properties, dose and effects of overdoses of the drug. Name the bitter principle, and state its behavior to hot diluted acids.

G. Ergot. Give the botanical name, and, as briefly as possible, the complete history of development of the fungus. What alkaloids have been obtained from Ergot? To which principles are the effects of Ergot believed to be due? Give an outline of the process for preparing these principles.

H. Give the botanical names and habitat of the plants of the natural order of Loganiaceæ yielding officinal seeds. Describe, briefly, the physical and structural characters of the seeds. Give the names, the percentage and the characteristic reactions of the two alkaloids found in these seeds.

I. Benzoin. Give the botanical name, natural order and habitat of the plant, and state how the drug is obtained. Describe the drug and point out the principal differences between Sumatra and Siam Benzoin. Name the constituents, give the percentage of the peculiar acid, and state how the presence of another acid sometimes present may be detected.

K. Cacao Butter. Give the botanical name, natural order and habitat of the plant; also the part of the plant yielding the oil and the percentage obtained. Give the physical properties and constituents of the drug and describe a test for the detection of adulteration.

THEORY AND PRACTICE OF PHARMACY.

A. Identify the following liquids by a calculation, and show how you obtained the results. 1. A pint of an officinal liquid weighs 6,562 grains, what is its specific gravity, and give the officinal name of the liquid? 2. Each fluidounce of two officinal liquids weighs 528·6 grains, give the specific gravity and officinal name of each. 3. A litre flask holds 1,250 grams of an officinal liquid, what is its specific gravity and officinal name?

B. Give the unabbreviated officinal names, ingredients, outlines of process, and describe the appearance of the following preparations of the U. S. P., 1880: Purified Animal Charcoal, Mustard Paper, Belladonna Plaster, Extract of Krameria, Saccharated Iodide of Iron, Solution of Arsenious Acid, Phosphorated Oil, Compound Syrup of Sarsaparilla.

C. What changes are apt to take place in the following preparations when exposed to either air, light or summer heat? Give the best method of protecting each: Succus Rubi Idæi, Potassii Carbonas, Tinctura Kino, Syrupus Ferri Iodidi, Pulvis Rhei Compositus, Magnesia Ponderosa, Pulvis Scillæ, Extractum Gossypii Radicis Fluidum.

D. State whether the following preparations are kept better in sealed packages or partially exposed to the air? Give reasons for your judgment, and name the best container for the dispensing counter for each preparation: Ergot, Rhubarb Pills, U. S. P., Taraxacum Root, Powdered Cloves, Acetate of Lead, Diachylon Ointment, Iodide of Calcium, Powdered Extract of Glycyrrhiza, Chlorinated Lime, Hydrocyanic Acid.

E. Give the English names, and ingredients used in the preparation of Abstractum Jalapæ, Bismuthi et Ammonii Citras, Ceratum Cantharidis, Confectio Rosæ, Decoctum Sarsaparillæ Compositum, Emplastrum Ammoniaci cum Hydrargyro, Extractum Belladonnæ Alcoholicum, Linimentum Terebinthinæ, Liquor Gutta Perchæ, Mistura Rhei et Sodæ.

F. Calculate the quantities in grains and fluidounces that would be required of each ingredient to make five pints of Tincture of Opium from the officinal formula. Put all of the figures on your examination paper that you used in obtaining the answer.

G. Give the test for recognizing the Aloins, Morphine, Quinine, Strychnine and Veratrine.

H. Describe, briefly, the usually accepted theory of the action of Pepsin, Extract of Malt, and Pancreatin on food. Give the sources and usual method of preparation of Pepsin and Extract of Malt.

I. Define incompatibility, as applied to prescriptions; is it ever intentional? State under what circumstances filtration may be used in compounding prescriptions. When is the pharmacist justified in making an addition to a prescription? Illustrate, by practical example, each of the above points.

K. What three physical qualities must a good pill mass possess? Why is each quality necessary? Define the term excipient. Name four excipients used in officinal pills containing aloes. Write out a prescription using proper abbreviations, ingredients and excipient for 24 pills each containing ½ grain of Permanganate of Potassium. Write out three forms of metric prescription for a four-fluidounce solution containing in each teaspoonful $\frac{1}{10}$ of a grain of Sulphate of Strychnine, one grain of Sulphate of Quinine, two grains of Citrate of Iron and Ammonium, and equal parts of Syrup and water.

CHEMISTRY.

A. What two methods can you give for the manufacture of Potassium Bromide? Explain the several chemical reactions that occur in each of these methods. What are the impurities to be looked for in Commercial Bromide of Potassium? By what tests are these impurities shown?

B. Give the chemical formulas for Magnesii Sulphas and Zinci Sulphas respectively. State the physical differences between the two compounds by which they may be distinguished. State by what qualitative analytical tests you could distinguish between them with absolute certainty.

C. What is the chemical composition of Hydrargyri Oxidum Rubrum, of Hydrargyri Oxidum Flavum? What are the physical properties of the two preparations? What is the chemical difference between Hydrargyrum Chloridum Mite and Hydrargyrum Chloridum Corrosivum? What is the chemical composition of Hydrargyrum Ammoniatum? How is it made?

D. What is "White lead"? Describe its manufacture. What is its officinal name, and what are the physical and chemical properties ascribed to it by the Pharmacopœia? What are its pharmaceutical and technical uses?

E. Give the chemical formula of Alumen, of Alumen Exsiccatum. State how the first is changed into the second, noting the limitations of temperature. Give the chemical formula of Aluminii Hydras, and state the officinal process for preparing it.

F. What is Ferrum Reductum? How is it made? Write the chemical reaction for this process. Give the chemical formulas of Ferri Oxidum Hydratum, of Ferri Chloridum, Ferri et Ammonii Sulphas, Ferri Oxalas.

G. What is the chemical composition of Petrolatum? How does it differ, chemically, from Benzinum? Describe the appearance and properties of the two substances. What are the pharmaceutical uses of each of these?

H. What is the chemical composition of both vegetable and animal fats? By what several processes can fats be decomposed? Write two reactions illustrating these different methods of decomposition. State what the products are in the respective cases. Is there any officinal process that involves the decomposition of a fat in any such way?

I. What is the difference between a Phenol and an Aromatic Acid? To which class does Acidum Carbolicum belong? Acidum Benzoicum? Acidum Salicylicum? Give the reaction for the artificial formation of this latter compound.

K. What is a Glucoside? What is an Alkaloid? What chemical reactions will serve as a means of deciding between the two classes? How are Glucosides decomposed, and what are the products of their decomposition?

COMMITTEE.

A. State the officinal title of Solution Subacetate of Lead. Write out the officinal process, and give the specific gravity of the solution. What precaution is necessary for its preservation, and why? Name two officinal preparations into which it enters, and give the formula for the preparation of each. Give the officinal definition, and a test of its purity.

B. Give the botanical name, habitat, officinal portion, important constituents and medicinal properties of one plant of each of the following natural orders: Ranunculaceæ, Rubiaceæ, Compositæ, Melanthaceæ, Umbelliferæ.

C. What is the officinal name of Phosphorated Oil? What percentage of Phosphorus does the oil contain? What fixed oil is used in its preparation? Give an outline of the process directed for making it. What is the object of adding the ether? What is the dose of Phosphorated Oil? What directions are given in reference to its preservation? What chemical change is likely to occur if these directions are neglected?

D. Name the principal constituents of Milk. State how they may be separated from each other. Name an officinal *Solid* obtained from Milk, and state its principal use in pharmacy. What officinal *Liquid* is derived from milk? What officinal *Salt* does this liquid enter into?

E. Give the natural order and habitat of Atropa Belladonna. Briefly describe the physical properties and the structural characteristics of the officinal portions of the plant. Give the officinal name and chemical formula of the chief active constituent of Belladonna. What is the largest *safe* dose of this constituent? Name three other plants of the same natural order containing nearly or quite identical principles. When the active

constituent of Belladonna is treated with dilute Hydrochloric Acid, what are the products of its decomposition! Give the officinal name, part used and ordinary dose of three *galenical* preparations of Belladonna. To what other important drug is Belladonna therapeutically antagonistic?

F. Give the officinal title and definition of the following drugs; also, state the botanical name, natural order and habitat of the plants which furnish them: Camphor, Star-anise, Scammony, Coca, Asafetida, Guarana, Mastic, Staves-acre, Jaborandi, Nutgall.

G. At what temperature does water attain its greatest density? What is the officinal unit for comparison of the densities of solid and liquid bodies? What is the weight in grams of a decilitre of officinal Nitric Acid? What is the weight in grams of a litre of officinal Ether? What is that officinal liquid, half a litre of which weighs 1,050 grams?

H. Give the officinal name, specific gravity and symbol of Mercury. Name some of the localities from which it is obtained, and state in what combination it usually exists in nature. What process is generally employed in separating it from this combination? Give both the boiling point and congealing point of Mercury, F. What two series of salts are formed by Mercury? To which series does Corrosive Sublimate belong? State its dose and chemical formula, and give a test for it in solution. To which series does Calomel belong? Give its chemical formula. Name three officinal preparations into which Mercury enters in the metallic state.

I. State the commercial methods used in the preparation of Starch. Into what is it converted when boiled with dilute acids? Give the chemical formula of Starch and its test. What is the chemical formula of Glucose? Give a test for it. How does it differ, chemically, from Cane Sugar? Describe the chemical reaction that takes place when Glucose is subjected to fermentation. Give the officinal name of the principal product formed.

K.

1.

Would you dispense this prescription? Give your reason why.

℞ Atropinæ Sulphatis..... gr. ii
Aquæ Destillatæ..... f℥ii
Fiat solutio.
Signa. Take a teaspoonful every four hours.

2.

Would you dispense this prescription? Give your reason why.

For Mr. Hayes' infant.

℞ Bismuthi Subnitratis..... ℈i
Misturæ Cretæ ..... f℥iss
Tincturæ Opii..... f℥ss
Misce, signa. Give a teaspoonful every four hours.

3.

Would you dispense this prescription? Give your reason why.

℞ Arsenii Iodidi..... ..... gr. iv
Hydrarg. Iodidi Viridis gr. viii
Ferri Iodidi..... gr. xxxii
Misce, fiant Pilulæ No.. xxxii
Signa. Take one pill three times a day.

4.

How would you prepare this prescription? State the chemical action occurring, and give the reason for each step in the process.

℞ Acidi Hydrochlorici..... gtt. xv
Potassii Chloratis..... ℥iss
Aquæ Cinnamomi..... f℥iv
Signa. Take a teaspoonful every hour.

5.

Write out a direction for preparing this prescription, and give your reason for so doing.

℞ Morphinæ Sulphatis..... gr. ii
Tincturæ Tolutanæ..... f℥ss
Aquæ..... ..... f℥iiiss
Misce et signa. For cough. Take a teaspoonful every four hours.

6.

Write out a direction for preparing this prescription, and give your reason for so doing.

℞ Olei Sabinæ..... m. xx
Pulveris Aloes..... gr. v
Misce, fiant Pilulæ No..... xx
Signa. Take one pill three times a day.

The following specimens were examined by the candidates:

Materia Medica.	Pharmacy.	Chemistry.	Committee.
Bryonia,	Ferri sulphas exsicc.,	Potassii bitartras,	Aqua Menthæ piperitæ,
Arn cæ radix,	Amylum iodatum.	Sodii bicarbonas,	Acetum Scillæ
Cinchona rubra,	Pulv. Glycyrrhizæ comp.,	Ammonii chloridum,	Syrupus Pruni Virgin.,
Xanthoxylum,	Petrolatum.	Magnesii sulphas,	Podophyllum,
Buchu (long),	Extractum Gentianæ,	Zinci sulphas,	Scilla,
Pilocarpus,	Aqua Camphoræ,	Plumbi acetas,	Buchu (short),
Juniperus,	Liquor Sodæ chloratæ,	Acidum aceticum,	Anisum,
Coriandrum,	Tinct. Lavandulæ comp.,	Acidum gallicum,	Potassii nitras,
Linum,	Syrupus Hypophosphitum,	Amylum,	Sodii boras,
Aloe.	Extract. Spigeliæ fluidum	Alcohol.	Zinci sulphas.

In the examination on Operative Pharmacy the candidates were required to prepare—

1. Suppositories composed of butter of cacao, and containing extract of stramonium and tannin:

2. Lozenges, containing extract of glycyrrhiza, gum arabic, sugar, oil of sassafras, oleoresin of cubeb and syrup of tolu;

3. Emulsion, 4 fluidounces, containing 1 fluidounce of oil of turpentine;

4. Compound pills of iron, and

5. To spread a soap plaster 6 x 4 inches.

The examination in Analytical Chemistry was for the first time required and showed in its results that most of the students were practically familiar with the principles of analytical chemistry. Each candidate was furnished with a solution containing three or four salts, and was required to search for both bases and acids within two hours. The following is one of a number that were given: Aluminium sulphate, Potassium acetate, Ferric chloride, Cupric nitrate.

The following 150 students passed the examination, and were recommended to the Board of Trustees for the degree of Graduate in Pharmacy (Ph. G.):

Frederick William Alexander, New York, *Linimentum Ammoniæ.*
Charles Spencer Allen, New Jersey, *Pharmacy Laws and Ethics.*
Harry Warren Anderson, Maine, *Medicine Chest.*
Grace Lee Babb, Maine, *Microscopy of Malt.*
Thomas David Baker, Pennsylvania, *Piscidia Erythrina.*
Harry Lee Barber, Pennsylvania, *Menispermum Canadense.*
Abraham Lincoln Ballinger, New Jersey, *Impurities in Myrrh.*
William Hart Betts, Pennsylvania, *Caffea.*
Edwin K. Beans, Jr, Pennsylvania, *Tobacco.*
Charles Wesley Bollinger, Pennsylvania, *Preparation of Medicines.*
Jacob Curtis Bollman, Pennsylvania, *Clerk and Student.*
Edgar Ellsworth Booze, New Jersey, *Lead and Lead Salts.*
William Carlton Boynton, Maine, *Spigelia.*
Walter S. Bray, Maine, *Tests for Albumen.*
Frank Frederick Bridgeman, Wisconsin, *Sodii Bromidum.*
Matt. Ashley Briggs, Georgia, *Eriodictyon Californicum.*
Buchanan Carter, North Carolina, *Sodii Chloridum.*
William E. Cassell, Pennsylvania, *Convallaria Majalis.*
Isaac Eugene Chandler, Pennsylvania, *Opium.*
Abraham Theophilus Clayton, Pennsylvania, *Castanea.*
William Lincoln Cliffe, Pennsylvania, *Iris Versicolor.*
La Rue Robert Colegrove, New York, *Adulterations.*
John Joseph Coleman, West Virginia, *Cephaelis Ipecacuanha.*
L. D. Paul Collins, Ohio, *Rhus.*

Harry C. Cook, Ohio, *Erythroxylon*
William Alexander Cook, Georgia, *Potass. Chlorate and Syr. Ferri Iodidi.*
Joseph Crawford, Pennsylvania, *Martynia Proboscidea.*
Samuel Douglas Crawford, Pennsylvania, *Ergota.*
Charles Thomas William Cress, Pennsylvania, *Disinfectants.*
John Whiteside Custer, Pennsylvania, *Pills.*
Frederick Augustus Dalpe, Pennsylvania, *Baycura.*
Francis Leaming Darrach, Pennsylvania, *Phytolaccæ Baccæ.*
John Jenkins Davies, Pennsylvania, *Boric Acid.*
Bernard H. De Huy, Kansas, *Aqua Marina.*
William Dutton, New Jersey, *Pharmacy.*
Eugene Gustav Eberle, Wisconsin, *Cascara Sagrada.*
Charles Matthew Edwards, Maryland, *Sanguinaria.*
Edmund Hann Evans, Pennsylvania, *Crystallization.*
Milton Smoker Falck, Pennsylvania, *Cimicifuga.*
John Charles Falk, Missouri, *Assay of Citrate of Iron and Quinine.*
Charles Louis Feldkamp, Illinois, *Pharmacopœia Extracts.*
William Anderson Fetters, Pennsylvania, *Potassium.*
Frank Penicks Fetters, Pennsylvania, *Opium.*
Eugene Anderman Fillman, Pennsylvania, *Stramonium.*
Robert Fechtig Finck, Pennsylvania, *To know all this is wholesome.*
George Thomas Fitzgeorge, New Jersey, *Glycerin.*
Philip Thomas Fitzpatrick, Pennsylvania, *Cambogia.*
Daniel Follmer, Pennsylvania, *Honey.*
Frederick Henry Fox, New York, *Syracuse Salt Water.*
William Hubbell Gano, Jr., Delaware, *Scaled Salts of Iron.*
Charles Gardner, Iowa, *Zea Mays*
John Goldbach, Ohio, *Decoctions and Infusions.*
Frank Barr Groff, Pennsylvania, *Pills of Permanganate of Potash.*
Humes Hall, Pennsylvania, *Pepsin.*
Robert Newton Harper, Virginia, *Extractive Matters of Drugs.*
William Henry Harrison Headley, Pennsylvania, *Salicylic Acid.*
Eugene Samuel Heiberger, Pennsylvania, *Creosote.*
Robert Lewis Hesson, Pennsylvania, *Caffeina.*
John Michael Hillan, Pennsylvania, *Maydis Stigmata.*
Levi Ellsworth Hinckley, Ohio, *Our Pharmacists.*
Levi Brook Hirst, New Jersey, *Coating of Pills.*
Ephraim Zeigler Hoffman, Pennsylvania, *Convallaria Majalis.*
Calvin Jerome Houck, Pennsylvania, *Sanicula Marilandica,*
Oscar Houck, Wisconsin, *Sorghum Sugar.*
John Thompson Huff, Virginia, *Oleum Morrhuæ.*
George Herman Ischler, Pennsylvania, *Cosmoline.*
Elmer Ellsworth Johnson, Pennsylvania, *Zinc.*
Thomas Crawford Johnston, Pennsylvania, *Crystallization.*
James Frederick Judd, England, *Rhamnus Purshiana.*
Frederick Rudolph Keller, Pennsylvania, *Syrupus.*
George Dering Keller, Pennsylvania, *Education for Pharmacists.*
John William Keller, Pennsylvania, *Emulsions.*
William Clarence Kelly, Pennsylvania, *Acetic Acid.*
William Henri King, Pennsylvania, *Opium.*
Albert Henry Kinsey, Ohio, *Dispensing by Drops.*
George Lewis Klump, Pennsylvania, *Abuses in Pharmacy.*
William Matthew Koenig, Pennsylvania, *Prunus Virginiana.*
Charles Franklin Krum, Pennsylvania, *Phosphorus.*
Louis Carl Kusenberg, Pennsylvania, *Hydrogen Sulphide.*
John Douty Kutzner, Pennsylvania, *Chemical Affinity.*
William Harrison Laubach, Jr., Pennsylvania, *Biborate of Lithium.*
Charles Elsner Lawall, Pennsylvania, *Glyceritum Amyli.*
Harry Bellerjeau Leeds, New Jersey, *Rhus Aromatica.*
Robert Leithead, Jr., Delaware, *Pilocarpus Pinnatifolius.*
Isaac Edward Leonard, Pennsylvania, *Oleum Gaultheriæ.*

Clement Belton Lowe, Pennsylvania, *Silico-Fluorides.*
John Sloan McCauly, Pennsylvania, *Jamaica Dogwood.*
James Ralston McCausland, Pennsylvania, *Value of Pharmaceutical Associations.*
Wm. John McConn, Pennsylvania, *Precipitate from Tinct. Sanguinariæ.*
Franklin McCoy, Ohio, *Maydis Stigmata.*
Tracy McKenzie, Texas, *Cinchona Bark*
John Clarence McVicker, West Virginia, *Mineral Waters.*
George Frederick Maddock, New Jersey, *Salts of Lithium.*
Henry Wilbur Maitland, Pennsylvania, *Success in Pharmacy.*
Emlen Martin, New Jersey, *Cantharis.*
John Edwin Martin, Pennsylvania, *Emulsions.*
Harry Lovett Miller, Jr., Illinois, *Analysis of Phosphoric Acid.*
Andrew Herman Joseph Maguire, England, *Tincture of Nux Vomica.*
Frank Xavier Moerk, Delaware, *Malt.*
Christian Moore, Pennsylvania, *Bismuth.*
John August Morris, Pennsylvania, *Syrups.*
Louis Murjahn, Pennsylvania, *Teucrium Scordium.*
James White Murrow, Pennsylvania, *Cascara Sagrada.*
John Anthony Murtagh, Pennsylvania, *Chalybeate Pills.*
Thomas Oliver Nock, Delaware, *Abstracta.*
Chas. Herman Oberholtzer, Pennsylvania, *Maydis Stigmata.*
William Ogilby, Pennsylvania, *Mineral Acids.*
Frank Boyd Olmstead, New York, *Potassii Iodidum.*
Melmoth Mercer Osborne, Pennsylvania, *Boroglyceride.*
Gomer David Owen, Ohio, *Bromide of Potassium.*
Evan Ingstrum Pattengill, New York, *Fluid Extracts.*
Edward Sing Petrie, New York, *Cinnamic Acid.*
Harlan Page Pettigrew, Dakota, *Oils of Birch and Wintergreen.*
William Chandler Pierce, Delaware, *Adeps Benzoinatus.*
Henry Charles Plenge, South Carolina, *Aloin.*
James Arthur Pool, Illinois, *Granulated Citrate of Magnesium.*
Edmond Preston, Jr., Maryland, *Phytolaccæ Radix.*
Elmer Delaney Prickitt, New Jersey, *Corn Silk.*
Wm. Van Dyke Reading, Pennsylvania, *Percolation.*
William Reisert, Pennsylvania, *Bismuth Breath.*
Charles Templeton Ritter, Pennsylvania, *Iron Preparations.*
Joshua Ellis Rohrer, Pennsylvania, *Caulophyllum Thalictroides.*
Walter Arabin Rumsey, New Jersey, *Cornus Florida.*
Frank Gibbs Ryan, New York, *Magnesii Carbonas.*
Luther Johnson Schroeder, Pennsylvania, *Extractum Glycyrrhizæ.*
Henry Francis Schuldt, Pennsylvania, *Guarana.*
Edward Wolf Sharp, New Jersey, *Electricity.*
Austin Charles Sherman, Pennsylvania, *Sublimation.*
William August Singer, Illinois, *Estimation of Iron Ore.*
George Ellsworth Spangler, Pennsylvania, *Aqua Pruni Serotinæ.*
B. Franklin Stahl, Pennsylvania, *Acidum Hydrocyanicum Dilutum.*
Charles Mays Steinmetz, Pennsylvania, *Elixirs.*
Alexander Frederick Streitz, Nebraska, *White Wax and its Adulterations.*
Clarence Draper Sypherd, Maryland, *Rhubarb.*
Edward Weeks Tedford, Tennessee, *Deportment of Students.*
James Harry Thomas, Pennsylvania, *Prinos Verticillatus.*
Edwin Allen Trist, Pennsylvania, *Scutellaria Lateriflora.*
John Henry Trout, Pennsylvania, *Chelidonium Majus.*
Fred. Lang Urben, Pennsylvania, *Ether.*
Frank Elliott Valentine, Ohio, *Infusum Digitalis.*
Parry Wyche Vaughan, North Carolina, *Prunus Viginiana.*
John Martin Broomall Ward, Pennsylvania, *Unguentum Aquæ Rosæ.*
William Porter Watson, Pennsylvania, *Potassium.*
John Alvin Weaber, Pennsylvania, *Guaiacum.*
Alexander Arthur Weber, Pennsylvania, *Verbena.*

George Alcimus Weirich, Pennsylvania, *Boldo.*
Alfred Jefferson Wenner, New Jersey, *Oleic Acid.*
Anthony Smith Wickham, West Virginia, *Potassii Bromidum.*
George Thomas Williams, Delaware, *Syrupus Calcii Lactophosphatis.*
Elmer Ellsworth Wilson, Pennsylvania, *Pharmaceutical Manipulations.*

We have been prevented from obtaining the names of those who passed a meritorious examination.

The evening of March 18 saw the members of the graduating class and of the Board of Trustees together in the museum, to participate in the Professors' supper before bidding a final farewell to the graduates. The latter presented to the College a finely executed portrait of Professor Sadtler; various speeches were made and a few hours were spent in pleasant intercourse.

The formal closing of the sixty-third session of the College took place on the evening of March 19, at the Academy of Music where the commencement exercises were held and the degree of Graduate in Pharmacy was conferred upon the above candidates by the President of the College, Dillwyn Parrish. The following prizes were awarded: Mr. Jas. T. Shinn, on behalf of the Board of Trustees presented the Procter prize, a gold medal, to J. C. Falk, he having attained the grade "very satisfactory," in each of the seven branches of examination. The Secretary of the College, Mr. Wm. J. Jenks presented the Henry C. Lea prize, one hundred dollars, to F. X. Moerk for the best thesis, with honorable mention of Miss Grace L. Babb, H. L. Barber, J. Crawford, F. A. Dalpe, M. S. Falck, J. M. Hillan, A. H. Kinsey, J. McConn, T. McKenzie, T. O. Nock, E. S. Petrie, E. Preston, Jr., A. F. Streitz, F. G. Ryan, M. M. Osbourne, G. A. Weirich, and L. J. Schroeder. The materia medica prize, a Zentmayer histological microscope was presented by Vice-President Bullock, Prof. Maisch being absent on account of sickness; the recipient was H. L. Barber, and M. C. Falck received honorable mention, for the histological and chemical examination of an American drug. The Pharmacy prize, a gold medal, for a collection of Pharmaceutical preparations made without any special apparatus, was presented by Prof. Remington, to T. O. Nock, with honorable mention of P. W. Vaughan. The chemistry prize, a Troemner analytical balance, for analytical work, was presented to F. X. Moerk, with honorable mention of H. P. Pettigrew and O. Houck. Mr. Wiegand, on behalf of the Board of Trustees, presented to H. C. Cook the Prof. Maisch prize, twenty dollars in gold, offered by Mr. J. H. Redsecker, of Lebanon, Pa., for the best microscopical examination of drugs. Vice-President Shoemaker received for the absent Prof. Maisch from Mr. W. H. King, on behalf of the graduating class, a handsome group of Rogers' statuary.

The valedictory address was delivered by Professor Remington, and the exercises closed with the distribution of flowers and numerous presents which had been sent upon the platform by the friends of the graduates.

Seven students participated in the examination of microscopical specimens of drugs, in competition for the prize offered by Mr. Redsecker; three others, who had also attained the grade "very satisfactory," in the examination in materia medica, were absent from the city. The sections were prepared in such a manner that all cell contents were absent, and only the

tissues shown. They were Apocynum cannabinum (root), Glycyrrhiza glabra (rhizome), Triticum repens (rhizome), Arnica montana (rhizome), Cinnamomum zeylanicum (bark), Cinchona succirubra (bark), Pimpinella anisum (fruit), Nux vomica (testa and albumen), Coffea (albumen), Lupulinum (glands, dry). Each one of the specimens was identified; apocynum, glycyrrhiza, coffee and lupuline once; cinchona by six, cinnamon by five, the remainder by four and three students. Mr. H. C. Cook recognized six of the specimens.

ALUMNI ASSOCIATION OF THE PHILADELPHIA COLLEGE OF PHARMACY.—The twentieth annual meeting was held in the room of the Association at the College hall, on Monday afternoon, March 17, 1884.

The President delivered his annual address, and the Secretary and Treasurer submitted their annual reports. The Executive Board held regular meetings during the year, and the Association had five social meetings during the winter, which were well attended by the students and members. The senior and junior quiz classes were a success, financially, also the class in microscopy. The spring class numbered six and the winter class 16 students. It was proposed to continue the spring course, as usual, in microscopy. During the year 95 graduates joined the association and seven died, leaving a membership of 833 at the close of the annual meeting.

The resolution was offered that a committee of five be appointed of the association to collect funds, and place in the vestibule of the College (by permission of the Board of Trustees) a tablet bearing the names of the original and such early members of the College as registered on the roll previous to 1823; the tablet to bear the inscription "erected by the Alumni Association of the College."

The following officers were elected for the ensuing year; President, Dr. Chas. A. Weidemann, class 1867; Vice-Presidents, Jacob S. Beetem, class 1878; Second Vice-President, Wm. R. Warner, Jr., class 1881; Recording Secretary, Wm. E. Krewson, class 1869; Corresponding Secretary, David W. Ross, class 1877; Treasurer, Edward C. Jones, class 1864; Executive Board, L. E. Sayre, class 1866; Jos. W. England, class 1883; Trustees of Sinking Fund, Thos. S. Wiegand, class 1844; Orator for 1885, Edward Hopper, Esq., class 1833.

The twentieth annual reception was held on the evening of the same day in the Pharmacy lecture room. The annual oration was delivered by Robert H. Vansant Ph.G, and the valedictory in behalf of the graduating class, by Wm. H. Gano. The usual Alumni prizes were awarded, viz.: Gold medal to John S. Falk, of St. Genevieve, Mo., and certificates in materia medica, to H. P. Pettigrew, of Sioux Falls, Dakota; in pharmacy, to Harry C. Cook, of Columbus, Ohio; in chemistry, to Frank G. Ryan, of Elmira, N Y.; in operative pharmacy, to Grace Lee Babb, Eastport, Me.; in analytical chemistry, to Wm. L. Cliff, of Philadelphia; and in general pharmacy, to Henry C. Plenge, of Charleston, S. C. The junior testimonial was awarded to Wm. Henry Clark, of Madrid, N. Y.

THE NEW YORK COLLEGE OF PHARMACY held its fifty-fourth annual

commencement in Steinway Hall, on the evening of March 18th. An account of the exercises and a list of the graduates has not been received.

ST. LOUIS COLLEGE OF PHARMACY.—The eighteenth annual commencement exercises were held at Memorial Hall on Wednesday evening, March 12th, 1884. The President of the College, H. E. Hoelke, delivered an appropriate address, and conferred the degree of Graduate in Pharmacy on the following candidates:

Henry H. Barth,	Adolph J. Hoenny,	Fred. Wm. Schumacher,
James M. Borton,	Wm. O. Kempinsky,	Arnold Sellner,
Oscar F. C. Bausch,	Otto Kollme,	Robt. H. Smiley,
Geo. G. Berg,	Chas. C. May,	Otis W. Smith,
Chas. H. Biermann,	Julius C Meisenbach,	Wm. O. Steinmeyer,
Chas. F. Blank,	Chas. E. Meyer,	Chas. H. Stoll,
Wm. T. Carr,	Chas. Mueller,	Otto Sutter,
Fred. D'Amour,	Henry Muetze,	Joseph A. Temm,
Adolph G. Enderle,	Wm. E. O'Melveny,	Otto Ude,
Peter T. Entrekin,	Geo. L. Phelps,	Fred. Volz,
Wm. H. Fogas,	Louis Francis Reber,	August Vogt,
Emil W. Godron,	Edgar N. Sanders,	Geo. H. Wagner,
Louis C. Haagen,	Ernest C. Scholer,	Jno. W. Westman,
Henry J. Helwig,	Herman C. Schuh,	Francis Zerr.

Honorary mention was made of Adolph G. Enderle, Charles F. Blank, Henry Muetze, Francis Zerr, William O. Kempinsky, Henry H. Barth, Adolph J. Hoenny, Robert H. Smiley. The above names are given in the order of their general average of the examination in all branches.

The Alumni prize, a gold medal, was awarded by Francis Hemm to F. W. Schumacher, of Waco, Texas, for obtaining the highest proficiency in all branches. The valedictory address, on behalf of the class was delivered by James M. Borton, of Marion, Ill. A very interesting and instructive address, on the part of the College, was delivered by Rev. S. H. Sonneschein. After the distribution of many beautiful floral offerings and with enlivening music the exercises closed.

The College had an enrollment of 120 students during the session just closed.

THE MARYLAND COLLEGE OF PHARMACY held its thirty-second annual commencement at the Academy of Music, in Baltimore, on Tuesday afternoon, March 25th. The degree of Graduate in Pharmacy was conferred by President, Joseph Roberts, upon the following candidates:

Louis Bellerman, Maryland, *Tinct. Nucis Vomicæ.*
Charles Buschman, Maryland, *Chemistry.*
Reinhart L. Brown, Ohio, *Boric Acid.*
E. J. Bernstein, Maryland, *Heat.*
Charles E. Davis, Pennsylvania, *C. P. Acids.*
John A. Davis, N. Carolina, *Resinoid Substances.*
William C. Downey, D. Columbia, *Hydrargyrum and its Compounds.*
William L. Dunham, Pennsylvania, *Chromium.*
J. K. Eppley, Maryland, *Pharmacy.*
Charles W. Forrest, Maryland, *Cantharis.*
John C. Groome, Pennsylvania, *Hydrargyri Chlor. Corros.*
H. H. Hatheway, Ohio, *Pharmacy.*
John M. Hennick, Maryland, *Carbon.*

George Kolb, Maryland, *Plumbum.*
Louis F. Kornmann, Maryland, *Zinc.*
Elmer E. Moyer, Pennsylvania, *Carbon.*
Charles Metzger, Maryland, *Podophyllin.*
William B. Orear, Maryland, *Eucalyptus.*
Thomas L. Richardson, Maryland, *Pills and Pill Excipients.*
Thomas K. Shaw, Maryland, *Cannabis Indica.*
W. L. Sulzbacher, Ohio, *Pepsin.*
George H. Stuart, Maryland, *Powdered Extracts.*
Charles Shipley, Maryland, *Ergot.*
Frederick Sultan, Maryland, *Salicylic Acid.*
Conrad P. Strauss, Maryland, *Citric Acid.*
Louis Schultze, Maryland, *Hydrargyrum.*
Purnell F. Sappington, Maryland, *Belladonna.*
W. B. Taliaferro, Virginia, *Analytical Chemistry.*
J. Curtis Treherne, Virginia, *Cinchona Preparations.*
J. Henry Woodcock, N. Carolina, *Sulphur.*

The College prizes, gold medals, were awarded to C. P. Strauss, W. L. Sulzbacher and L. F. Kornmann; the Simon analytical prize, a gold medal, to F. W. Sultan; the Practical Pharmacy prize, a Troemner Solution Balance, to T. L. Richardson, and the prize to the Junior class, a copy of Hoffmann and Power's Analytical Chemistry, to Lee M. Whitsitt. The valedictory Address was delivered by Rev. C. E. Felton.

EDITORIAL DEPARTMENT.

PARTIAL DESTRUCTION OF POWERS & WEIGHTMAN'S LABORATORY.—Shortly after 12 o'clock on the morning of February 29th, a portion of the western wing of this laboratory was discovered to be on fire. It originated from some unknown cause in the third story of the building, in a locality where cinchona bark was ground, and when first seen by the watchmen was not considered to be of sufficient magnitude to summon outside aid. But the steam pumps of the establishment proving unavailing to subdue the fire, an alarm was sounded which brought the fire department to the spot. A fierce northwest gale fanned the flames which were nourished by the combustible material within the building, and gradually spread to the southwestern end where the carpenter shop was located, and thence eastward along Brown street, and to the buildings which had been erected in the central yard. All these buildings were of a very substantial character, which helped very materially to confine the destructive element, notwithstanding the high wind and the intensely cold weather. The fire raged until after daybreak, when it was under sufficient control to prevent it from spreading further, but it continued to burn and to smoulder for many hours afterward.

Most of the burned buildings had been erected in the place of those which had been destroyed by fire just sixteen years before, on February 29, 1868. The principal chemicals destroyed were quinine, morphine, chloroform, potassium iodide and others, mostly such as were in course of preparation. The northern half of the extensive establishment along Parrish and Ninth streets was saved; it is here where the counting room, the extensive store-

rooms and other important departments are located. Several large warehouses belonging to the firm, are in the immediate neighborhood at a short distance from the scene of conflagration; these were not touched by the fire. A large portion of the laboratory works, where acids and other heavy chemicals are mainly manufactured, is located at Schuylkill Falls, a distance of several miles from the burned buildings.

The ruins are being taken down, and new buildings will soon take the place of those destroyed. We understand that the firm has leased a factory at Mannheim, Germany, where for awhile quinine will be manufactured, and that it is the intention of transferring a portion of the manufacturing department to the extensive grounds at Schuylkill Falls.

THE OHIO PHARMACY LAW was finally passed March 20th, after a struggle of several years. We learn that this result has been reached in good part through the interest taken in the bill by Senator Reed and by Dr. Lisle, the Chairman of the Committee on Medical Colleges and Societies in the House.

The provisions of the law are simple. The Ohio State Pharmaceutical Association makes nominations; from these names and others the Governor appoints the Ohio Board of Pharmacy, consisting of five members, one of whom retires every year and another appointment is made for five years. The Secretary of the Board receives a salary and payment for traveling and other necessary expenses; the other members receive three dollars for each day of service and legitimate expenses; the surplus money is to be invested as a special fund. Those engaged in the drug business are required to register within three months; likewise the assistants, who are at least 18 years of age and have been employed in the prescription business for at least three years. All others are hereafter required to undergo an examination, previous to registration; for the latter a fee of $3 is to be paid by pharmacists and $2 by assistant pharmacists, and a triennial renewal of this license is required at a charge of $1 and 50 cents respectively. Complete returns are to be made annually to the Secretary of State and to the Ohio Pharmaceutical Association. The book of registration is to be kept at Columbus; the Board is to hold three regular meetings at Cincinnati, Columbus and Cleveland, and other meetings as may be necessary. Prescriptions may be compounded by registered pharmacists or qualified assistants or under their supervision, by others. The certificate of registration is to be conspicuously displayed. The law does not interfere with physicians supplying their patients with medicines, nor with the manufacture of proprietary medicines, nor with the business of country stores who may sell drugs in common use, like castor oil, senna, sage, juniper berries, licorice, etc.; also chemicals, like copperas, borax, blue vitriol, saltpetre, sulphur, Epsom salt, Glauber's salt, cream of tartar and bicarbonate of sodium; also certain preparations when compounded, put up and properly labeled with directions for use, by registered pharmacists or wholesale dealers, namely, paregoric, essence of peppermint, essence of cinnamon, essence of ginger, hive syrup, syrup of ipecac, tincture of arnica,

syrup of tolu, syrup of squill, spirit of camphor, number six, spirit of nitre, compound cathartic pills, quinine pills and "other similar preparations."

The violation of any of the provisions of the law is declared to be a misdemeanor, and involves a fine of not exceeding $50 for each offence, such fine not to affect the right to bring civil actions; the fines are to be placed in the county treasury for the benefit of the common school fund.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

Proceedings of the Fifth Annual Meeting of the Missouri State Pharmaceutical Association, held at St. Louis, October 23d to 25th, 1883. 8vo. pp. 57.

A brief account of the transactions at this meeting was published in "Amer. Jour. Pharm.," 1883, p. 633. The next meeting will be held in Brownsville, on the second Tuesday of June.

Bericht über Pharmaceutische Produkte, incl. künstliche Mineralwasser. Von Prof. Ed. Schaer. Zürich, 1883. 8vo, pp. 39.

Report on Pharmaceutical Products, including Artificial Mineral Waters.

At the Swiss national exhibition held last year, the crude drugs and the preparations used in medicine were classed among two different groups. Without entering into a description of the crude articles, Prof. Schaer gives a full and interesting report on the various products, which he classifies as follows:

1. Pharmaceutico-chemical preparations, like salts of metals and alkaloids, tartrates, benzoates, ethers, etc.

2. Galenical preparations, like syrups, tinctures, extracts, ointments, powders, etc., also fluid extracts, which are beginning to be used on the continent of Europe. Among the plants which are almost unknown here, and of which various preparations were shown, may be mentioned *Dentaria pinnata*, *Myrrhis odorata* and *Achillea moschata*, or *iva*.

3. New forms and so-called elegant preparations, like dosimetric granules, rectal and vaginal suppositories, bougies, medicinal pencils, compressed tablettes, gelatin and other capsules, etc.

4. Artificial mineral waters in syphons and bottles, and

5. Dietetic-medicinal preparations, mainly milk-sugar, lactin and extracts of malt; the latter, aside from those which are medicated with quinine, iron, etc., are prepared of two kinds, namely, the ordinary kind, which is free from diastase, and for special purposes, particularly in the treatment of children, an extract containing diastase.

The report contains much valuable information on this branch of the industry of Switzerland, and occasionally some pertinent remarks on the claims of the products exhibited.

International Review of Medical and Surgical Technics. Official organ of the American Association of the Red Cross. Published quarterly. Boston, Mass.: International Medical Exchange.

Ueber das Suberin. Ein Beitrag zur botanischen, pharmacognostischen, und chemischen Kenntniss des Korkes von Quercus Suber. Von Karl Kügler. Halle a Saale, 1884.

On Suberin. A contribution to the botanical, pharmacognostical and chemical knowledge of the cork of Quercus Suber.

The work for this thesis has been done at the University of Strassburg, and comprises more particularly the history of the development of cork, the formation of cork-cells and the chemical constituents of corks. Air-dry cork leaves between ·53 and ·64 per cent. of ash, of which lime and manganese form each over 25 per cent. Chloroform extracts from cork 12 to 13 per cent of soluble matter, about one-third of which consists of Höhnel's crystallizable *cerin* $C_{20}H_{32}O$, (not to be confounded with cerotic acid of wax, which was formerly called cerin.) Boiling alcohol now extracts from cork between 5 and 6 per cent. of tannin and phlobaphene. On boiling the cork now with an alcoholic solution of potassa, suberin was extracted and decomposed into glycerin (2·65 per cent.) and fatty acids (30 per cent.) the latter consisting of stearic and *phellonic acid* ($C_{22}H_{42}O_3$); a little coniferin was likewise obtained and converted into vanillin. Water subsequently extracted 3 per cent. of humin compounds, and left 22 per cent. of cellulose. Though suberin is a fat, it cannot be extracted from cork by simple solvents, because it is doubtless intimately inclosed by the cellulose molecules. The oxidation products obtainable from cork by means of nitric acid, like suberic, oxalic, azelaic, cerinic, etc., acids are derived from the fatty acids, and the cerinic acid is regarded as a mixture of various compounds.

Materia Medica e Therapeutica Brasileira. Vegetaes tonicos. These inaugural pelo Dr. Francesco Maria de Mello Oliveira, etc., Rio de Janeiro, 1883. 8vo, pp. 144.

Brazilian Materia Medica and Therapeutics. Vegetable tonics.

The flora of Brazil, like that of other tropical countries, is rich in medicinal and otherwise useful plants. Several of these have found a permanent place in the materia medica of most civilized countries; others have occasionally been used, and many others might doubtless be employed with more or less success. The treatise before us is confined to plants possessing tonic properties, and does not pretend to be exhaustive of this class. We observe there accounts of such well known plants and their products, like guarana, maté, coffee, coca, cacao, remijia, cinchona, dorstenia, vanilla and others, besides a large number of other plants which are less known outside of Brazil. The accounts of these plants embrace descriptions of the plants and drugs, the chemical constituents and medicinal properties. Besides a number of wood cuts, the pamphlet contains good lithographs of Tachia guyanensis (*caferana*) and Cinchona Calisaya (*cultivated*).

Cumberland Almanac for the Year 1884. Nashville: American Publishing Company.

This Almanac was furnished to the subscribers of the "Journal of Medicine and Surgery," Nashville.